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THE TREATMENT OF ACUTE INFECTIOUS DISEASES

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THE TREATMENT OF ACUTE INFECTIOUS DISEASES

BY

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To the memory of my father
SHERMAN T. MEARA
whose encouragement was my inspiration
this book is dedicated.

PREFACE

To the layman the word "physician" connotes a therapeutist; one whose professional end and aim it is to cure the sick. If he thinks of the physician at all as a student of the science of medicine or as a diagnostician it is only in the sense that he is busied with matters that shall lead to the prevention, cure or alleviation of disease; and yet every practitioner of medicine, seeking assistance in the exercise of his art, feels the disproportion of the much that is offered him of the cause, the course and the consequences of disease and the little that is afforded of the practical application of this knowledge to its legitimate uses, getting the sick man well. As a teacher of therapeutics I have always felt that this branch of medicine has been unduly neglected both in the college curriculum and in the text-book. With the text-book my experience has been that it either speaks in generalities assuming knowledge on the part of the student or physician, when such an assumption should annul its very reason for being, or it catalogues and compiles endless measures and procedures without effort to exercise a judgment of their relative values. The few exceptions to this statement make themselves conspicuous.

Successfully or not, it has been the attempt of the author to avoid these extremes of error.

Each chapter has been made to deal with an individual disease in a thoroughly practical manner; each little detail of procedure being explained so that the reader may actually apply it. Moreover, the reason for the procedure, as based on our latest information, both with respect to physical therapy and drugs, the author has sought to give.

Constant and confusing reference to the literature has been avoided, but an effort to give due credit has been made.

The book, finally, must be looked on as an expression of the author's individual opinion and will be didactic rather than critical.

A summary at the end of each chapter is designed to add to its usefulness as a ready reference for the busy practitioner and as a review to the student.

F. S. M.

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TREATMENT OF ACUTE INFECTIOUS DISEASES

CHAPTER I

FEBRILE CONDITIONS

GENERAL PRINCIPLES

It is one of the most hopeful features of modern therapy that it is taking cognizance of the fact that the organism has been perfecting means of defense since first it became the seat of disease and that these means of defense are to be read not merely in the subtile elaboration of antitoxic bodies in the tissues and the marshalling of counter-forces in the blood elements, but also in the alteration of the functions of organs. Emesis as a symptom is primarily an effort to unburden the stomach of deleterious substances; diarrhea is protective in the same sense; cough removes secretions which are both irritants and mechanical impediments to the respiration; pain ensures rest to an affected part and so on. Interference with these symptoms must be undertaken with discretion lest it become pernicious. It is the knowledge of when to let alone and when to interfere that constitutes the art of therapy. Emesis, diarrhea and cough may become a source of exhaustion; pain which has pointed the way to the trouble and hinted the need of rest be illy borne when continued and fever rise to degrees that are incompatible with its purpose and constitute hyperpyrexia. At this point, treatment steps in to modify and assist, not to disregard Nature's signals.

Fever, as the physician knows it, is almost invariably the result of bacterial action, so cannot be dissociated from toxemia; but pyrexia and toxemia show but little parallelism; indeed, the worst forms of toxemia may be accompanied by no pyrexia at all, while a relatively high temperature may be seen with a minimal toxemia. Briefly, then, unless the degree of temperature is inordinately high, that is, constitutes a hyperpyrexia, the treatment of fever is not an antipyretic treatment but an antitoxemic treatment, and such fall of temperature as accompanies our efforts is incidental to them and not the object at which we aimed.

The treatment of fever involves the appreciation of certain broad principles that in the main are physiological. They are not numerous, but they are of fundamental importance. We shall take them up seriatim. **(1) rest; (2) diet, including the ingestion of water; (3) fresh air; (4) water locally applied, that is hydrotherapy; (5) drugs; (6) hyperpyrexia.** I think it little matters what name we give the febrile process or the organism inducing it. The procedures are much the same.

Rest. It is a valuable form of mental exercise for a physician to pause occasionally and review some of the fundamental facts of physiology that are relevant to the problem in hand. First one should recall the fact that the sum total of the body's activities are but the expression of the conversion of potential energy of the food stuffs into these different forms of energies; that the body observes an accurate balance between the intake and output; that the law of conservation of energy obtains in the human body as well as elsewhere, and, therefore, when the intake is lessened, the expenditure should be diminished and useless forms of work should be avoided that useful purposes may be subserved.

All this means that in fever rest is imperative and that, as the body cells are expending energy in the elaboration of protective substances and the processes of repair are active in inflamed tissues, muscular unrest and muscular work should be avoided. Physiologists tell us that CO_2, an end product of the combustion of food stuffs in the production of energy may be taken as a measure of the energy of work and heat arising in the body and that the same man who during sleep eliminates 22 grams of CO_2 an hour will, when awake and exercising the greatest amount of muscular relaxation possible, eliminate 31 grams, and under conditions that we ordinarily term rest, such as most patients observe, eliminates 38 grams. These figures are cited to call attention to what a relative term "rest" is.

Again, in fever, the vascular and other vital centres are all too often sought out and when we recall the lessened number of heart beats in recumbency and slight fall of pressure under the same circumstances we appreciate the economy exerted in behalf of these organs by rest.

Rest means something more than **going to bed,** though that is imperative. It means that the bed must be comfortable, so that energy shall not be wasted in the effort to maintain strained positions or avoid uncomfortable ones; it means **competent nursing**; it means measures directed at sleeplessness and at delirium. **Mental rest** is equally important, for though the loss of energy in the mental processes *per se* is minute, strained and restless muscles are the results of anxiety and concern, as, indeed, are perverted functions in many organs. Leave the sick room to the sick; exclude solicitous friends, Job's comforters, mourners before the fact. Avoid the introduction of business matters or domestic concerns, and let quiet and order reign. The contrast between a well-ordered, neat, cool, sick-room, and a hot stuffy room with six to ten visitors, gas-jets in full action and Babel and Chaos regnant is one of the most striking that can be witnessed.

Diet. See Chap. II, *Diet in Acute Infectious Disease.* Again let us appeal to physiology for facts. They are (1) That the amount of **work** done and the amount of **heat** given off by the human body each day is derived **from the food** taken in that day or stored in the body from previous meals and that that store is not inexhaustible. (2) That the amount of **energy** supplied a man **at rest** each day amounts on the average to **33 calories**[1] **per kilo of body weight** which in a man of average weight amounts to 2,300 calories. (3) That a sick man at rest requires as many calories of energy as a well man. (4) That **fever** makes certain **demands** in excess of those obtaining in health, because the increased temperature *per se,* that is, pyrexia above 102° F. increases the output some 25 per cent. on an average, thus raising our caloric requirements to 40 per kilo or 3,000 for the man of average weight. (5) That the toxins of disease are destructive of body tissue in varying degrees, a destruction which may be overcome or minimized by a sufficient intake of food. (6) That the amount of **proteid** needed each day in health is about 100 grams. (7) That in fever the requirement is about the same or may be a trifle less, 75 to 85 grams, which is enough to prevent proteid loss when enough carbohydrates are added. The appreciation of these facts is increasingly important in the prolonged fevers, such as typhoid, certain bronchopneumonias or septic conditions.

One other fact is of special importance in orientating us correctly with reference to this subject; namely, that such studies as have been undertaken to determine the **efficiency** of the processes **of digestion and assimilation** of the foodstuffs **in fever** show that, except at the onset, these processes are scarcely impaired.

A sufficiency of food is an important item in the treatment of fever, because, as has been intimated already, an insufficiency leads to destruction of the body substance with the production of toxic material in the process, an autointoxication.

Briefly, in the beginning of fever, do not push the food; respect the meaning of anorexia; but later increase daily to the approximation of theoretical needs. Remember that there are other foods than milk that are easily digested, including cereals, bread, butter, eggs.

Water is an important item in the treatment of fever; all the water that the patient wants and his wants should be determined by offering him water at frequent intervals, as his cerebral condition may be such as to prevent his asking for the amount he needs.

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[1] A calory is that amount of heat that will raise one kilo of water through 1° C.

Studies of the water intake in certain infections such as pneumonia show that the amounts are sometimes extraordinary, 3,000 to 5,000 c.c. a day, and that the patients who are given a sufficiency seem to do best.

Fresh Air. That the sick require fresh air would seem a thesis too simple to require emphasis, and yet many physicians make no protest against the vitiation of the sick room by a swarm of visitors and burning gas-jets and make only a half-hearted appeal for an open window.

The bad effects of ill ventilation are due in part to the accumulation of CO_2 gas. In the country pure air contains about 3 volumes of the gas to 10,000 volumes of air. In rooms and work-shops it may rise to over 30 volumes, and in the night with the gas burning to nearly 50.

We consider it niggardly in the hospital if we do not allow 1,000 cubic feet to each sick infant, but how many of our patients get 1,000 cubic feet of fresh air to themselves in the sick room?

The increase of CO_2 is not the only evil in ill ventilation, for contamination of the air with bacteria and varied forms of dirt must ensue; while heat, moisture, and odors add their depressing effects.

But there is another quality to **fresh air when taken in the open** that adds materially to its value; it is the element of cold given either by the temperature of the air or by the effects of its movement. Pembrey, in a masterly article on Respiratory Exchange in Hill's *Recent Advances in Physiology and Biochemistry,* says, "The success of the open-air treatment depends it would seem, not so much upon any greater purity of the air as upon free exposure; the open air increases the combustion and respiratory exchange improves the appetite and augments the metabolism."

More than that, it is an every-day demonstration to the students in our ward that the exposure of the febrile patient to the open, cold, clear air **will induce a rise of blood pressure** over that obtained in a well-ventilated ward equal to or better than that obtained from our usual vasomotor stimulants, with the added advantage of being continuously sustained which does not obtain with the drugs.

I am convinced of the very great value of the **open air treatment** of fever. The pulse and respiration improves, the cerebral intoxication diminishes and the patients are almost universal in their commendation of it.

To reap success, however, the **technique** must be correct. The patient's bed must be so made as to keep the body always warm, by enclosing the bed in impermeable material like rubber sheeting or paper, the use of the hot water bottle, and by sheltering from winds. The good effects, I believe, come from the action of cold on the nerves of the mucous membrane of the nose or of the face, producing reflexly an improved vascular condition.

Water Locally Applied, Hydrotherapy. I am firmly convinced of the efficacy of remedial measures, operating on the various functions through the surface of the body, that branch of the healing art included under the head of physical therapy. This field has been grossly neglected for various reasons; in part because of the dominant position occupied by drug administration in the minds of most practitioners and very largely because of the time and effort entailed in the administration of these measures and the acquisition of a proper technique.

Water is a very valuable instrument in combating the evil results of fever. Baruch, whose persistent advocacy of hydrotherapy constitutes a real service to American Medicine and has not received half the recognition it deserves, points out that the value of water lies not so much in its physical constitution as in the fact that it is an admirable material for the conveyance of heat and cold and that strictly speaking, thermotherapy is a better term than hydrotherapy in the use of water. **A few facts should be borne in mind in considering hydrotherapy. (1) That we are aiming rather at the toxemia than at the pyrexia. (2) That the reaction to the use of cold water is the sine qua non of success. (3) That friction is as important as the cold in many of the procedures.**

The good effects of the cold water are obtained largely through the nervous system. The impulses pouring in through the countless nerves upon the centres result in a slower, stronger heart beat, and an improved vasomotor tone, which can be measured in terms of an increased blood pressure; respiration is deepened, cerebral processes improved, and metabolism enhanced.

Without detailing the various procedures, one may mention as the best known, the Brand bath in typhoid fever and the chest-compress in pneumonia.

Through the cold air and cold water we effect much the same results; the time of year, the facilities of the environment and the reaction of the patients determine an indication for one or the other.

Drugs. Drug administration, like the other measures, is aimed not at the pyrexia but at the toxemia, and that the fever is influenced is due to a relief of the toxemia or the conditions determined by it.

Cathartics occupy an important position among the drugs, because they prevent a stagnation within the bowel and the consequent absorption of putrefactive products.

The toxins of disease impinge upon the vital nervous centres and upon none more certainly than upon the vasomotor centre. Our great dread in the severe intoxication, such as typhoid fever, pneumonia, diphtheria, scarlet fever, and sepsis is a **circulatory failure.** The term "circulatory" is used advisedly, because upon this we can all agree, but when we try to fix this failure in the heart or in the vasomotor apparatus an abundant opportunity for difference of opinion arises.

My own belief is that the careful studies of this question show that in the large majority of cases it is the **vasomotor mechanism** that is at fault. For this reason drugs that act either on the vasomotor centre or on the vessels seem rational. My own choice at the present time is for **caffeine** and I think it should be given in sufficient dosage and so administered as to guarantee its arrival at the goal desired. I give it in the form of one of the soluble double salts, that of caffeine and sodium benzoate or caffeine and sodium salicylate, in doses of five grains every four hours, and such studies as I have made upon its effects on blood pressure show that its effects do not last even throughout this period. Next to caffeine, I use a 10 per cent. or 20 per cent. solution of **camphor** in olive oil and use more than the usual dose, giving at least five grains every four hours, hypodermically, often alternating with the caffeine, thus giving a dose every two hours. Personally I have less faith in strychnine.

That we can exclude the heart in all cases I do not believe and my experience leads me to believe that in all cases of circulatory failure the digitalis group is more reliable than the vaso-motors. I use digitalis in doses of one-half an ounce of the infusion (15 c.c.) three or four times a day or m. xxx (2 c.c.) of the tincture at the same intervals, and appreciating that it will not become operative in less than twenty-four hours, use in urgent cases as an initial dose one-half milligram (gr. 1/120) of strophanthin intramuscularly.

No mention has been made so far of the antipyretics. In the early stage with bounding pulse, aconite may afford some relief by slowing the heart through the vagus, the coal tars may be used with relief of headache and other pains, but here again the fall of temperature is incidental. These drugs are depressants and should never be used where the circulation is impaired.

Hyperpyrexia. As has been said, fever may be looked upon as of purposeful intent, as a conservative effort on the part of the organism to accomplish something useful to itself. If this be so, measures directed at the fever as such are misdirected if not pernicious, and it will be noted that the treatment of fever outlined in this chapter has been directed at the toxemia accompanying the febrile movement rather than at the latter; but as was said in the beginning, any symptoms primarily useful may in the end become harmful; one may say that Nature has overshot the mark. Excessive temperatures fall into this category as well as prolonged sustained temperatures.

Hyperpyrexia threatens cell function and cell integrity as increased proteid destruction shows. We see its effects best in insolation and in certain rheumatic fevers. In these cases reduction of heat is life saving.

We have no better method than the direct application of **cold** in the shape of cold baths or ice rubbed upon the surface of the body. The patient may be put into a bath of 90° F. and the water cooled down to 70° F. to 75° F. The body is kept immersed until the body temperature falls below the danger point, but it is wise to remove the patient when it falls to 102° F., as collapse may ensue on efforts to reduce it to normal. If such occurs, stimulants and heat are indicated, as in collapse from any other cause.

Antipyretics of the coal-tar group are not comparable in efficiency or safety to cold water, but may be used where it is impossible to use the latter.

No attempt has been made in this chapter to go into details; only generalizations have been laid down with special emphasis given to those branches of therapy commonly neglected, and for this reason serum therapy or vaccine therapy, which are specific for individual disease, have been omitted, but will be considered in their appropriate places.

SUMMARY

Symptoms of disease are primarily the expression of purposeful intent on the part of organs or tissues working under abnormal conditions; are conservative efforts and should be respected by the therapist.

Interference with symptoms is demanded only when, having subserved their purpose, by continuing they themselves become the source of exhaustion.

Fever is a term ordinarily used to cover both pyrexia and toxemia.

The treatment of fever, then, is the treatment of pyrexia and toxemia and, except in hyperpyrexia, more especially of toxemia.

The fundamental principles of the treatment of fever are:

1. Rest.
2. Diet.
3. Fresh Air.
4. Hydrotherapy.
5. Drugs.
6. Treatment of hyperpyrexia.

Rest.

Lessens demand on muscular and mental energy and conserves energy for purposes of repair and production of immune bodies.

Rest in practice means:

Rest in bed.
Comfortable bed.
Well ventilated room.
Good nursing.
Quiet.
Relief from anxiety and concern.
Sleep.

Diet.

Determined by the realization that the body heat and the performance of the functions of the muscles, organs and tissues demand a source of energy and that the only source of energy is food or the tissues themselves.

Energy demands at rest are the same for a man in health or in illness: about 33 calories per kilo or 2,300 calories for a man of 154 pounds.

Pyrexia increases demands by some 25 per cent. on an average, i.e., about 40 calories per kilo or 2,800 to 3,000 for an adult.

Toxemia by destruction of tissue makes even greater demands, especially in prolonged fevers, and amounts of food equal to 50–60–70 or even more calories per kilo may be given; the amount depending on the patient's ability to handle it and on the gain or loss of weight.

Proteid needs are from 65 to 85 grams.

The more prolonged the fever the more urgent the observance of food requirements.

Gastro-intestinal functions, secretion, motility and assimilation are affected but slightly in early days of fever or in profound intoxication.

Rules for Feeding.

Do not urge food in early hours or days of fever against the patient's anorexia, but when it disappears appreciate and provide for the demand for food.

Water should be given freely; offered to the patient, not awaiting his request.

Fresh Air.

Proper ventilation of room—exclusion of visitors. Open air—on verandah or porch—observing the proper technique in bed-making. (See Pneumonia.)

The value of fresh air consists mostly in its stimulating effects on vital centers, reflexly, through its effect on nerve supply to the skin of face and mucous membranes of air passages.

Essential factors.

Live air, moving air.

Hydrotherapy.

Effect same as that of air. Water is a conveyor of temperature. Cold stimulates vital centers reflexly through nerves from the skin.

Essentials to success. Water must be cold. Friction must be applied (it is the alternating cold of water and heat of hand that affords stimulation).

Patient must react.

Drugs.

Cathartics to prevent or relieve stagnation and absorption of products of putrefaction.

Circulatory stimulants.

Vaso-motor stimulants.

Caffeine in form of soluble salt (double salt of sodium salicylate or benzoate and caffeine). Dose gr. iij–v (0.20–0.30 Gm) every 4, 3 or 2 hours.

Camphor in 10 per cent. to 20 per cent. solution in oil (olive or sesame oil) in doses equal to gr. v, of the camphor every 4, 3 or 2 hours.

Heart stimulants. For immediate action strophanthin into muscle or vein. Dose, ½ milligram (gr. $\frac{1}{120}$). Follow up with or in less urgent cases begin with digitalis infusion ℥ss (15 c.c.) or Tincture m. xxx (2 c.c.) three or four times a day until desired effects ensue or signs of toxicity of any kind appear.

Antipyretics—for pain and discomfort at the beginning, in the sthenic stage and even then with caution.

Hyperpyrexia.

Sudden rise of temperature to 106° F., or above or prolonged temperatures of 104° F.–105° F.

Cold.

Best as baths. Put patient in at 90° F., and lower temperature to 75° F. or 70° F. Take out when temperature of body falls to 102.5° F.

Antipyretics indicated only when cold water is inaccessible.

Specific treatment. (See individual diseases.)

CHAPTER II

DIET IN ACUTE INFECTIOUS DISEASES

Feeding the sick is both a science and an art; a science in so far as it takes cognizance of the great laws of supply and demand in a physiologic sense; an art in so far as it affects the application of these laws to the individual.

Energy. All matter is endowed with a certain amount of energy, which manifests itself differently, under different conditions. Certain chemical substances, by virtue of the nature of the elements that compose them and their relationship to each other, that is, their structure, have the power to produce one or more manifestations of energy. They are said, then, to have **potential energy.**

To give rise to the manifestations of energy, these substances must have a certain degree of instability or lability; that is, must be capable under definite conditions of undergoing changes in structure, disruptions, etc., all of which give rise to motion.

The substances of which our bodies are composed and food on which they continue to exist are chemical substances of a highly labile character, possessing potential energy, which in the process of catabolism or breaking down, give rise to motion, which conveyed to other bodies is manifested as work or is expressed as heat, to neglect the lesser forms of energy in the human body, such as the electrical.

Energy is as indestructible as matter itself. It can be **transformed** from one kind to another, but it cannot be destroyed nor yet created anew. Different manifestations of energy have definite quantitative relationships to each other, as Joule's great experiments on the mechanical equivalent of heat showed. He demonstrated that the amount of work necessary to raise 1 Gm of water through 1° C. was that required to raise 42.55 Gm through 1 cm. of distance.

I have said that the **conversion of** the potential **energy** of the body or of the food into one or the other manifest forms of energy occurs under definite conditions. The definite condition in the body which gives character to its manifest energy is the "vitality" of the cell. Moore[1] calls the **living cell an "energy transformer."** He says:

"The living cell is not a peculiarly constructed membrane obeying, even where it seems most directly not to obey, the physical laws of diffusion and osmosis; but is an energy machine or transformer by virtue of the operation of which a form of energy appears, peculiar in its manifestations and phenomena to living matter."

---

[1] *Recent Advances in Physiology and Biochemistry,* edited by Leonard Hill, London, 1908.

The kind of energy that this transformer, the living cell, produces out of the potential energy of the body and its foodstuffs is almost entirely **thermokinetic,** that of work and heat, and as we can express work in terms of heat, we may reduce the total activities of the body to terms of heat and express them as equal to so many "calories" or heat units.

The "calorie" is a term used to express that amount of heat which is required to raise 1 c.c. or Gm of water through 1° C. More properly, this is termed a "small calorie," while the term "large calorie" is used for the amount required to raise 1 kilogram or 1 liter of water through 1° C., i.e., 1 large calorie equals 1,000 small calories. Calories referred to in this work are large calories.

The Caloric Balance of the Human Body. As has just been said, the human body (the cells collectively) is an energy transformer; or to put it in other terms, the human body is like a steam-engine, consuming fuel for the purpose of doing work and producing heat; but the human body differs from a steam-engine in this, that, lacking fuel, it will consume its own structure up to the point of a complete collapse of the mechanism; so that, to maintain the integrity of the transformer or engine, it is necessary that the output by it of work and heat shall be exactly met by the fuel afforded it. To know the amount of food the human body requires, then, we must know the amount of work it does and the amount of heat it elaborates in a given time.

Now Nature has given to the individual a most amazing regulator to adapt the supply to the demand on which no device of man can ever improve; that is, **appetite.** When one thinks that day after day and year after year, the body retains a fixed or approximate weight, under the most varying demands of work, and consequently of food, under the guidance of this monitor, one is lost in admiration; but as there are times, in the stress of disease, that this regulator fails or by the dictates of false theories, is disregarded, we need to know what the demands actually are, in order that we may guarantee that they may be met.

The **determination of the caloric output** in man has been made possible by the use of the calorimeter chamber of Pettenkofer and Voit, elaborated and perfected by Atwater and Benedict, whose work in this field has been the most extensive and accurate ever done, and whose studies of food-values have been accepted by the government as standards; and by the study of the respiratory quotient determined by the simpler apparatus of Zuntz.

Work. Still another way to determine the **caloric needs of man** is to determine the heat values of the foods habitually taken by normal individuals in **different callings.** These analyses of the average intake and output agree wonderfully well. For men doing light or sedentary work, clerks, professional men, literary men, the requirements are between 2,400 and 2,600 calories; for those whose work is a little more arduous, as machinists, shoemakers and the like, 2,900 to 3,100 calories; for those doing hard muscular work, smiths, masons, etc., 3,300 to 3,600 calories, while those doing very hard work run up much higher, the Maine woodsmen demanding some 7,000 to 8,000 calories. Football players require nearly as much.

What concerns us most is the **requirement of a man at rest,** for this is the condition in which we find our patients. Rest, too, is a relative term, and as used here means that degree of activity which obtains when a patient is put to bed, which is a very different state from complete muscular relaxation or that prevailing in sleep. At rest the demands are about 2,300 calories or 33 calories per kilo of body weight, the average man weighing 70 kilos or 150 pounds.

A fact of prime importance to us as practitioners is that educed from the work of Magnus-Levy,[1] namely, that the total metabolism is the same in the sick man as in health, so far as the demands of muscular effort and heat production go; but, as we shall see, fever and toxemia increase these demands.

Weight. The caloric requirement of an individual depends not only on the amount of work he does, but also on the size or bulk of his body; and while we have spoken of the requirements of a man at rest as 2,300 calories, it is meant for a man of average weight, while such wide variations as a man of 200 pounds and a woman of 100 pounds are common in our every-day experience. The requirements are best thought of in units of weight, as so many calories per kilo—for a man at rest 33 calories per kilo.

Here, too, certain modifications have to be made, as in the excessively obese, whose fat is hardly to be considered in the same light as the more actively metabolizing tissues.

Age. The figures "33 calories per kilo" obtain only for adults. In the young the growth has to be taken into consideration, which in certain periods is more intensive than in others; e.g., in the first three months of life the demands are about 110 calories per kilo; in the second three months, 100; in the last half of the first year, 90; at the end of the second year, 75 to 80; at 10 years, 60, and at 14 years, 52. Indeed, as Cohnheim observes, the boy of 10 requires as much food as the adult who does not do muscular work, while the youth of 14 to 16 must eat 3,000 calories, about one-fourth more than his father who leads an intellectual life.

Body-surface. In consideration of the fact that in all warm-blooded animals the production of heat is the most imperative function of metabolism, and further that the dissipation of it is largely a function of the skin, there stands a relationship between these two, closer than that between metabolism and weight. In a small sphere the surface is greater, proportionally to the contents, than in a large one, for the contents increase as the cube of the radii, while the surfaces increase as the squares, so that in the smaller bodies the radiation is relatively greater and the heat production must be relatively more intense.

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[1] Quoted from Otto Cohnheim: *Die Physiologie der Verdauung und Ernährung.*

So it is that we find in the infant a requirement of 100 calories against 33 in the adult, but when the surfaces are compared, it is found that reckoned in calories per square decimeter, it is about the same from 10 weeks to adult life, 13 to 14 calories per square decimeter (Pfaundler and Schlossmann). The unit of weight is, however, so much more readily obtained that we use it in preference.

Metabolism experiments carried on during rest have shown that whether reckoned on the one unit or the other they are always the same for all individuals, men or women, sick or well. It must be remembered, however, that the conditions of the experiment produce more nearly real rest than obtains in the sick-room. Differences of temperament determine very different degrees of muscular activity, while certain phases of an acute infection, like delirium, become a matter of serious import in the consideration of rest.

As has been said, all this energy manifested as work and heat by the body, resides potentially in and is derived from the food. The food, then, must furnish periodically just what the body has expended in order to keep the latter intact, for if the food is deficient, the deficit will be made up out of the body itself, as long as it can stand the drain. Our patient at rest, then, must have 2,300 calories of food a day.

Caloric Value of Foodstuffs. The foodstuffs are divided into three classes, fats, carbohydrates, and proteins. Strictly speaking, salts and water are foodstuffs, but they have no caloric value.

Rubner's figures for the caloric value of foodstuffs still stand to-day, such slight modifications as have been made having but little practical significance. They are as follows:

1 Gm of fat furnishes 9.3 calories.
1 Gm of carbohydrate furnishes 4.1 calories.
1 Gm of protein furnishes 4.1 calories.

With these figures and a table of the average composition of the common foods, like those of Atwater, published by the U. S. Department of Agriculture, it is no difficult task to arrange a dietary.

The first step, then, in arranging a diet in acute infectious diseases, is to provide, as a minimum, as many calories as are demanded by the individual when at rest in health, 33 calories per kilo, or 2,300 in the average man.

A diet must not only contain sufficient heat units, it must also be properly balanced with reference to the three foodstuffs, and of these three, the most important is protein.

Protein Needs. Two facts of great importance are to be kept in mind, which differentiate protein from the other foodstuffs; first, in the adult, under normal circumstances, the daily demand for protein is fixed and does not vary with the amount of work done, as is the case with the other two foodstuffs; and second, there is no provision for a storage of an excess of protein, as is the case with fats and carbohydrates. Therefore, any excess must be catabolized and eliminated.

This daily amount of protein amounts to about 100 Gm, or 16 Gm of nitrogen. Voit's figures are 118 Gm of protein as ingested, which, allowing for the amount found in the stools, gives about 100 Gm net. The analysis of dietaries the world over has given a remarkable unanimity of results, which have confirmed Voit's figures.

That a man may perform hard work for months and remain in excellent condition on an amount of protein far less than this, one-half and even less, has been demonstrated by Chittenden in the most elaborate and extensive set of experiments ever carried out on this subject. Physiologists, however, though they must accept the possibility of this low protein need as a fact, are not yet inclined to argue from this demonstration that such an intake would subserve the interests of the organism in the long run to the best advantage.

Functions of Protein. Protein subserves three important functions. First, it furnishes substance, building material, to the body. This is spoken of as the "storage" of nitrogen. Second, it repairs the daily waste of the body, the wear and tear of the machine. Third, it furnishes heat in its combustion, that is, is a fuel.

It is only in early life that the first of these functions, **storage**, is of prime importance. At that time it is one of the most imperative of physiologic functions. The continuance of growth, when weight may be stationary or regressive, is a familiar phenomenon to the pediatrist, expressive of the fact that the protein is seized on with avidity even when the fuel-value of the food is insufficient for body needs. It is a curious fact that the actual amount of protein ingested in infancy is about the same month after month, but the amount devoted to storage decreases, while that used for wear and tear increases. In the first two weeks over 75 per cent. is stored; at two months 40 per cent.; at five months 23 per cent. When an individual has attained his or her growth, storage ceases, except on special occasions; these are during pregnancy and lactation, in the establishment of hypertrophy of groups of muscles, as in the training of an athlete, and during convalescence from wasting disease or after a long fast.

The second function, repair of **wear and tear**, is the important one in adult life. This has to do with maintaining the integrity of the machine as a whole and has nothing to do with the amount of muscular work, so it is a daily constant, regardless of the amount of exertion the body has been put to. It is for this purpose that the food should contain 100 Gm of protein a day in the adult diet.

The third function is incidental. Protein does **furnish heat,** but it is not an economical source of supply. In the infant the proper amount of protein furnishes about 7 per cent. of the calories; in the adult about 14 per cent.

The reason that protein is not an economical fuel lies in that peculiar property known as its **"specific dynamic action."** When food is ingested, the physiologic processes sequential to it produce heat. The amount of such heat induced by fat and sugar is slight and negligible, but not so protein. The ingestion of this substance gives rise to a production of heat equal to a trifle more than 30 per cent. of its caloric value.

The source of this heat is a matter of dispute, but it would seem to be due to the work of the glands of secretion and to cell activities with which we are less acquainted. Lusk has intimated that in the case of protein it may be in part due to the denitrogenization of the amidobodies. This heat is lost to the body, is waste heat, under the conditions of temperature and physical regulation of heat in which man lives. He cannot utilize this heat for purposes of cell-life.

This loss of heat by the specific dynamic action of protein may be expressed in this way: that to get the caloric value of 100 Gm of protein one must ingest 140 Gm of the food. It is this increased heat that must be dissipated that has led naturally to a limitation of meat diet in hot weather and to its general elimination from the diet of fever.

The second step, then, in arranging a diet in the acute infectious diseases, is to provide enough protein to replace the wear and tear, an amount which hardly differs from the general demand in health. It may be placed at 65 to 80 Gm.

Fat and carbohydrates differ from protein in two very striking ways as articles of diet; first, when utilized by the body the oxidation is complete and they are eliminated as carbon dioxid or water, while the nitrogenous moiety of the protein is not completely oxidized and entails work on the part of the kidney to eliminate it, which the other foodstuffs do not require; second, an excess of fat and sugar beyond immediate needs is stored in the body as fat and does not demand prompt elimination like the excess of protein.

The proportions of the three foodstuffs in an average dietary is protein 100 Gm, fat 50 Gm, and carbohydrates 400 to 500 Gm, giving in the neighborhood of 3,000 calories.

Milk. No food in infectious diseases has been used so much as milk, and frequently to the exclusion of all others.

An excellent milk will show on **analysis** about 4 per cent. of fat, 4.5 per cent. of sugar, and 3.5 per cent. of protein, or, to the liter, 40 Gm of fat, 45 Gm of sugar, and 35 Gm of protein. Using Rubner's caloric values as given above, we see that the caloric value of a liter of milk is 700; reduced to quarts, there are about 640 calories to the quart, or 20 to the ounce—a convenient figure as a mnemonic.

A liter contains 35 Gm of protein or 1 Gm to the ounce.

It will be seen presently that a low estimate of the caloric needs in fever of an average individual is 3,000. To meet this one would have to administer over a gallon of milk, which would contain over 140 Gm of protein.

These figures sufficiently demonstrate how illy adapted an exclusively milk diet is to meet the needs of an individual suffering from an acute infection.

Standard Portions. When one comes to study the tables of composition of foodstuffs, it is plain that the establishment of a dietary to respect the caloric requirements and the protein needs of a patient is a task outside the time and patience of an active practitioner. It was with an appreciation of this fact that Professor Irving Fisher, of Yale, published his tables of standard portions.

It will be seen from the table representing a few of these articles selected how remarkably the ordinary servings of common articles of food, or at least multiples or simple fractions of them, amount to just 100 calories.

In some of our hospitals the nurses are now instructed to bring food to the patient in these portions, so that the estimate of the daily intake can be easily made with a degree of accuracy that answers all practical purposes, and because the daily exhibition of these portions is an education to both the medical and nursing staffs. It soon becomes an easy matter to think of the ordinary articles of diet in terms of units of 100 calories.

TABLE OF FOOD-VALUES IN UNITS OF 100 CALORIES[1]	Protein in Gm
Milk, 5 oz.	5.
Cream, 16 per cent. (2 oz.)	1.5
Buttermilk, one and one-half glasses (9.5 oz.)	8.
Koumys, one glass (7 oz.)	5.
Whey, two glasses (13 oz.)	3.5
Eggs, one and one-half	10.
Whites of eggs, 6	24.
Yolks of eggs, 2	4.5
Oatmeal, one and one-half serving (5.5 oz.)	4.25
Boiled rice, ordinary cereal dish (3 oz.)	2.5
Hominy, large serving (4.2 oz.)	2.5
White bread, home made, one thick slice (1.25 oz.)	3.2
One small Vienna roll (1.25 oz.)	3.2
Butter, one pat (0.5 oz.)	0.0
Sugar, three teaspoonfuls, one and one-half lumps (0.8 oz.)	0.0

[1] Adapted from Prof. Fisher's Tables.

TABLE OF FOOD-VALUES IN UNITS OF 100 CALORIES—*Continued*	Protein in Gm
Oil, one-third ounce	0.0
Codfish, two servings (5 oz.)	23.
Halibut steaks, one serving (2.8 oz.)	15.
Mackerel, Spanish, one serving (2 oz.)	12.2
Shad, one serving (2.1 oz.)	11.2
Salmon, small serving (1.5 oz.)	7.3
Oysters, 12	12.
Roast beef, ordinary serving (1.8 oz.)	10.
Small sirloin steak (1.4 oz.)	7.5
Leg of lamb or mutton, ordinary serving (1.8 oz.)	10.
Lamb chop, one, small (1 oz.)	6.
Bacon, small serving, medium fat (0.5 oz.)	1.5
Chicken, broiler, edible portion, large serving (3.2 oz.)	19.
Turkey, large serving (1.2 oz.)	7.
Potato, baked, one, good size (3 oz.)	3.75
Potato, sweet, baked, one-half average potato (1.7 oz.)	1.5
String beans, five servings (16.66 oz.)	3.75
Spinach, two ordinary servings (6.1 oz.)	3.7
Peas, green, one serving (3 oz.)	5.7
American or Swiss cheese, 1.5 cubic inches (0.75 oz.)	6.
One baked apple, 3.3 ounces	0.5

The object of our consideration is a patient suffering from an acute infectious disease. So far I have discussed only the food requirements of a man in health at rest. Such a discussion is relevant to this subject, however, because the requirements of the patient are the same plus a certain additional need determined by the infection itself.

There are four factors that enter into the problem of feeding in acute infectious diseases that render it distinct. They are (1) gastro-intestinal disorders; (2) pyrexia; (3) toxemia; (4) starvation.

Starvation in fever has been a tradition in medicine that has lost but little authority with the passage of time and finds wide acceptance to-day. The legitimacy of such practice I wish to examine.

Disturbance of Gastro-Intestinal Function. It cannot be denied that the gastro-intestinal tract is not indifferent to the effects of the infection. We are all familiar with the dry mouth, the coated tongue, the anorexia and the tympanites of many of the patients.

One feels little inclined to urge food on so unwilling a receptacle and this feeling has plead potently with many practitioners to establish insufficient, often starvation dietaries.

Investigation has shown that the salivary secretion is lessened, that the output of hydrochloric acid is diminished and the motility of the distal portion of the intestine is impaired. It has been claimed that the motility of the stomach, too, is prejudiced (von Leyden and Klemperer), but von Noorden maintains that that has not been the case in the patients he has studied.

More important still, assimilation seems to be good, and von

Leyden and Klemperer[1] found that in different patients with high fever 89 per cent. to 94 per cent. of easily digestible fat was absorbed and 91 per cent. of protein. Moreover, they found no carbohydrate in the stools unless excessive amounts had been ingested or diarrhea prevailed.

Taking these data and what I have seen of liberal feeding in febrile conditions, I am convinced that the ability of the alimentary tract to perform its normal functions in fevers has not been duly appreciated and the withholding of food on the supposition that this organ is crippled is unjustifiable.

I do believe that in the incipiency of an acute infection these functions are more in abeyance than later, but that they quickly become competent. I also believe that the state of the mouth and digestion is due in no small measure to an insufficiency of water and is greatly aggravated, not by the giving of food, but by the withholding of food, which entails a destruction of body tissue and sets on foot abnormal metabolic processes.

Fever. The term "fever" as ordinarily used, connotes the sum of two distinct factors: (1) pyrexia, and (2) toxemia. These will be discussed separately, and when, under pyrexia the word "fever" is used, it is to be taken in the sense of an elevated temperature alone, i.e., pyrexia.

Pyrexia. There has been an endless controversy from remote times as to the significance of fever, it being contended on the one hand that it was a deleterious factor in the disease, on the other, that it was beneficial and had a meaning that was to be respected; purposeful, the teleologist would say.

This is not the place to discuss at length fever and its relation to disease, but I am in agreement with the conclusions of careful students of the subject that "fever is a specific reaction against injurious materials which affect the tissues"; that it "is in its essentials a protective reaction," to quote from the excellent article on fever by Dr. W. G. MacCallum.[2]

There has been a wealth of work done to prove this statement, which one will find set forth in detail in the article just referred to and in a critical review of the subject by Hermann Ludke.[3]

Pyrexia below 104° F. is to be let alone; it is useful; above that figure it adds an element of harm and then antipyretic measures are indicated, but not till then. It must be remembered that many so-called antipyretic measures, such as the cold baths, are directed not toward the temperature, but to the circulatory and nervous system, and are of the highest value when these systems are in distress. The phenomena of fever lead rapidly to the assumption that there is a great increase in heat production and a marked retardation of heat dissipation, in other words, a great accumulation of heat in the body. This is only partially so. The actual increase in the oxidative processes is relatively small, while the relation between heat production and heat dissipation is but little interfered with. What seems actually to take place is the regulation of these processes on a higher level, so to speak; what level, that is, at what temperature, depending on the effects of the toxins on the heat-regulating mechanism. This mechanism, however, under such conditions, does not display the same degree of stability as in the normal individual, but a lability that characterizes the temperature curve in infections, and, indeed, gives their individual stamp to them.

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[1] Von Leyden and Klemperer: *Handbuch d. Ernährungs-Therap.*, 1904, ii, 332.

[2] MacCallum, W. G.: *Arch. Int. Med.*, 1909, ii, 569, and the *Harvey Lectures*, 1908–1909.

[3] Ludke, H.: *Ergebn. d. Inn. Med. u. Kinderh.*, iv, 493.

I have said that the increase of heat production in fever is relatively small. The figures vary; sometimes there is no increase, but on the average it amounts to about 25 per cent. This might seem considerable did we not pause to consider that in strenuous muscular exercise the increase of heat amounts to several hundred per cent.; for example, the 8,000 calories of the Maine woodsman to the 2,300 at rest.

The fact that such great increase in heat in the normal man causes no rise of temperature shows that the elevated temperature of fever requires an additional factor to that of heat production; that it is the result of the toxins as well as heat. However, as our patient is at rest, this 25 per cent. increase has to be added to the 2,300 calories allowed him, in order to make good his daily losses, **so that it may be said that the requirement of the febrile patient is 40 calories per kilo or 2,800 calories, near enough to 3,000 to make that our guide.**

One other effect of pyrexia I wish to mention; that is, its destructive action on protein. As Lusk says, "Infectious fevers are characterized by a toxic destruction of body protein"; but there are three factors concerned in the loss of nitrogen during an acute infectious process; (1) pyrexia, (2) toxins, (3) starvation.

The study of non-toxic fevers, such as are induced by exposure to heat or by puncture of certain parts of the brain, show that the **pyrexia** can induce protein catabolism, but it seems to demand a temperature of 102° F. or over to bring about this protein loss, and experimentation has shown that a sufficient feeding can control this loss.

Toxemia. It was recognized that apart from the effect of pyrexia and apart from starvation, or at least in the presence of food sufficient to meet all the theoretical considerations we have so far set forth, there still continued to be a considerable loss of protein in the acute infectious diseases. This loss came to be accepted as inevitable by the ablest investigators in the field and was attributed to the effects of the toxins and was called the "toxic destruction" of protein. Just how the toxins brought about this protein loss was and is a matter of conjecture. It has been attributed by Krehl to actual cell destruction; by others to an exciting effect on metabolism by the toxins; by others to an expression of the production of antibodies and other protective substances. Certain it is that it is dissociated from the pyrexia, as such; for it is often intense when there is no rise of temperature. Taken with this destruction it has been suggested that a weakened power of regeneration exaggerates the difference between catabolism and anabolism.

Starvation. This does not belong to the acute infections as a rule, except as it is inflicted on the patient by an insufficient dietary. Energy must be supplied to the body each day and when the food does not do it, the body substance does and the protein is called on to do its share at the sacrifice of cell integrity.

At the present moment one of the most intensely interesting fields of medical research is that devoted to metabolism, the building up and breaking down, anabolism and catabolism, the storage of energy and its dispersion; what one writer has called the "most fundamental characteristic of life, energy-traffic." The intimate processes of protoplasm yield their secrets stubbornly, but we know what they have to work on and we know what they yield back; we know the fuel and the ash, the intake and the output, and from the knowledge of these two, we deduce much that has occurred in the process of the change.

Nitrogen is the basic substance on which the body structure is erected. It is ingested with the food and it is expelled in the urine, the stools and in lesser measure by the skin. In health the intake and output balance each other, and the nitrogen eliminated is divided among a number of combinations which maintain a pretty constant relationship to each other. These nitrogen combinations are spoken of as the "**nitrogen partition.**"

In disease the balance of intake and output is disturbed and the relationship of the combination undergoes a change, so that the study of the nitrogen partition in disease is a tree that bears much fruit.

I have said that the **nitrogen elimination** is divided among three organs, the kidneys, the intestine, and the skin. As for the **skin,** its output is negligible except when made to functionate in an unusual manner, as in very profuse perspiration. Under such circumstances it has been known to yield as much as 0.75 to 1 Gm of nitrogen.

The stools, however, contain an appreciable amount of nitrogen. Some very curious ideas prevail even among physicians about the feces; e.g., that they represent the residue of the food; that the amount depends entirely on the amount of food ingested; that if there be no food taken there should be no feces. The stools do not represent the residue of food so long as the food is free from indigestible matter. Stools occur in fasting people and a comparison of these stools with those ordinarily passed shows that there is no difference in their composition or relation of constituents, no matter whether there be much or little food taken, and no matter whether that food be protein, carbohydrate or fat. The amount increases but little with the food and in no sense in proportion to the amount ingested. If excesses of food are eaten, a minimum residue may appear and, of course, cellulose or other indigestible substance is found.

The stools are made up of the residues of the digestive juices, mucus, desquamated epithelium, bacteria, the products of bacterial action, salts and water. Of the salts, it must be remembered that the intestine is the excretory organ for iron and calcium and for the most part of phosphorus and magnesium.

The nitrogen content varies from 1 to 2 Gm, but on the whole is so constant that it has been considered as furnishing a definite per cent. of the nitrogen ingested (15 per cent.) without prejudice to the accuracy of the metabolism study.

It is to the urine that we turn, however, to derive important information; for 80 per cent. to 90 per cent. of the nitrogen is excreted by the kidney as urea, uric acid, ammonia, xanthin bases, creatinin, and amidobodies.

The study of the total excretion and of its individual constituents is of importance.

Total Nitrogen. It has been invariably found that the amount of nitrogen excreted in fever far exceeds the amount ingested, and so much the more, the more severe the process.

It is common enough to find losses of 8 Gm, 12 Gm, 16 Gm, and more of nitrogen a day; that is, in excess of the intake; and, that, too, when on a diet usually considered satisfactory. This latter figure is the amount of nitrogen demanded in Voit's standard dietary, and if it were interpreted in terms of muscle tissue would mean a loss of a pound of such tissue.

Such figures will be found repeatedly in the tables of Shaffer and Coleman's studies on metabolism in typhoid fever,[1] and those of Wolf and Lambert[2] on pneumonia, to mention some of the most elaborate of the recent investigations.

The study of the total nitrogen and the determination of the "negative nitrogen balance," as it is called, tells us that there has been loss of substance to the body, but it does not tell us what tissues are suffering this loss, nor yet whether the metabolic processes are

[1] Shaffer and Coleman: *Arch. Int. Med.*, 1909, iv, 538.

[2] Wolf and Lambert: *Arch. Int. Med.*, 1910, v, 406.

carried out in a qualitatively normal manner. Such scant information as we have along these lines is derived from the study of the parts that go to make up the total; that is, the nitrogen partition.

It is the small portions that in the past excited but little interest that are now yielding us the most information. One of these portions is the substance **creatinin.** When Folin [1] published his classical analyses of thirty normal urines, he called attention to the fact that this substance creatinin remained practically constant, no matter what the amount of protein ingested. On this fact he elaborated the theory that this substance was an indicator of "tissue" or "endogenous" metabolism in contradistinction to "intermediate" or "exogenous" metabolism, of which urea is the chief representative. Another representative of this "constant" or "endogenous" metabolism is neutral sulphur,[2] and to a lesser extent, uric acid and ethereal sulphates.

Folin showed that this substance was constant in the individual, but varied in different individuals according to body weight. He spoke of it as an "index to the amount of a certain kind of protein metabolism occurring daily in any given individual," [1] but defined that kind of "protein metabolism" no further.

Shaffer,[3] however, added to our information a little further, by showing that not only was the output of creatinin in an individual constant from day to day, but also from hour to hour, amounting from 7 to 11 mg. of creatinin nitrogen for every kilogram of body weight per twenty-four hours; this he called the "creatinin coefficient." He, moreover, gave reason to believe that the substance was an index, not of total tissue metabolism, as Folin thought, but of one tissue metabolism, that of the muscle, as its output seemed to show a parallelism to the muscular efficiency or strength of the individual. It has nothing to do with the muscular work, but rather with the machine, the muscle itself. He suggests that it is an index of muscle tone. If one may use an analogy without too close adherence to details, one might consider the creatinin to represent the friction, the daily wear of the muscle machine, not at all the product of its work.

Here was an important clue to follow up. Any substance that showed the ravages of disease in so important a tissue as muscle was worth looking after. Already studies on the substance in pathologic conditions had assisted to suggest the above view of its significance and further work confirmed it.

It was found that creatinin was diminished in conditions of muscular inefficiency, such as amyotonia congenita, myasthenia gravis, muscular dystrophy,[1] exophthalmic goiter, and in the as yet undeveloped muscles of the infant.[2]

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[1] Folin: Approximately Complete Analysis of Thirty Normal Urines; Laws Governing the Chemical Composition of Urine; A Theory of Protein Metabolism, *Am. Jour. Physiol.*, 1905, xiii, 45, 66, 117.

[2] The importance attributed by Folin to neutral sulphur as an expression of "endogenous" metabolism has more lately been called into question.

[3] *Am. Jour. Physiol.*, 1908, xxiii, 1.

How is it affected by acute infectious fevers?

There is a pretty constant agreement among the investigators that it is increased during the height of the fever and is most marked when the nitrogen loss is the greatest, but there is no numerical relationship between the two. During convalescence and even before, there is a diminution in the excretion which may be attributed to muscular weakness. It must be interpreted in the sense that the febrile condition increases the wear and tear of the muscle tissue. This increase in creatinin was determined for typhoid fever,[3] for pneumonias, for erysipelas—to call attention to some of the most recent work.

So much for increased wear and tear of the protein constituents of the body during the acute infectious process; but is there anything that bespeaks by its presence actual destruction of a definite tissue? There is a substance in the tissue closely allied to creatinin, which differs from it only by the presence of one molecule of H_2O in its structure (creatinin is a dehydration product of creatin), which does not appear normally in the urine, or appears only in traces. This is called **creatin.**

Creatin is to be found in the urine only in abnormal conditions. It is found in wasting diseases, such as the cachexia of carcinoma, in starvation, and in fevers. It is derived from the muscle and its presence in the urine means destruction of the substance of that structure. It is very striking during the involution of the uterus after childbirth. It was found in all the studies on fevers referred to, and sometimes ran over into convalescence. Its disappearance from the urine is looked on as a good omen, and what interests us as dietitians is that when made to appear in starving animals it has disappeared under a pure carbohydrate diet.

Besides the creatinin, neutral sulphur and uric acid are both increased and may be looked on as further expressions of increased endogenous metabolism.

So far we have considered quantitative changes rather than qualitative in the nitrogen metabolism. Qualitative changes might be taken as evidence of metabolic inefficiency.

Evidence of this is to be looked for in the so-called **"rest nitrogen."** This "rest nitrogen" or "undetermined nitrogen" is that nitrogen which is left of the total nitrogen when the nitrogen of urea, ammonia, uric acid and creatinin have been subtracted. If the "rest nitrogen" increases it may be considered as being at the expense of the urea, the most important nitrogenous substance, and so indicate a defective desamidation. The amido-bodies are, indeed, the most important of the substances included in the "undetermined nitrogen." There are, besides leucin and tyrosin, indol, skatol, glycocoll, proteic acids and albumoses, as well as xanthin bases.

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[1] Spriggs: The Excretion of Creatinin and Uric Acid in Some Diseases Involving the Muscles, *Quart. Jour. Med.*, 1907–1908, i, 63.

[2] Amberg and Rowntree: The Excretion of Creatinin in the Infant, *Bull. Johns Hopkins Hosp.*, February, 1910.

[3] Klercher: "Ueber Ausscheidung von Kreatin and Kreatinin in fieberhaften Krankheiten," *Ztschr. f. klin. Med.*, 1909, lxviii, 22.

Shaffer and Coleman found but little increase in the "rest nitrogen" in typhoid fever and the same was true of pneumonia investigated by Wolf and Lambert (there was absolute increase, but not in disproportion to total nitrogen). It may be said, then, that as a rule the urea-forming function is but little impaired, an important conclusion in considering the ability of the liver to handle the products of protein digestion.

In grave cases, such as were observed in the study of typhoid metabolism by Ewing and Wolf, the "rest nitrogen" did become high and the urea low.

These authors looked on the phenomenon as indicative of inefficiency of the liver urea formation, recalling the high "rest nitrogen" found in acute yellow atrophy.

Such patients probably suffer from an auto-intoxication in addition to the toxemia of the disease.

All this shows that in acute infectious diseases there is a loss to the intrinsic structure of the body and that while such loss is entirely compatible with a perfect urea-forming function—and, indeed, the latter is but rarely impaired even in severe cases—there are yet a certain number of grave cases in which the liver has apparently through grave changes in its structure found itself incapable of desamidation and abnormal metabolic processes are in evidence.

With this knowledge it should be the effort of the therapeutist to prevent this loss and perversion of function, or at least to mitigate them. Can the administration of food accomplish this, and, if so, how shall it be ordered?

It would seem natural to conjecture that if the body was losing 10 Gm, 15 Gm, or 20 Gm of nitrogen a day over the intake, such a loss could be made good or prevented by increasing the intake of nitrogen to that amount. The truth of the matter is that neither the amount of the loss nor any other amount, without the help of the other foodstuffs, can bring about a nitrogenous equilibrium in man.

The recent work of Folin and Chittenden, showing the small amount of nitrogen which is really needed to establish an equilibrium, would lead us rather to use the smallest amount of protein necessary and avoid the breaking down and elimination of the superfluous nitrogen radicles, by organs burdened with disease, and increasing the heat to the fevered organism by the "specific dynamic action" of the protein.

Shaffer and Coleman were able to establish nitrogen equilibrium in typhoid fever on from 10 Gm to 15 Gm of nitrogen, when sufficient carbohydrate was used. This amount will be seen to be less than the Voit standard demands, by a considerable margin.

Fat and carbohydrate both spare protein; not, of course, replacing it, for they are both nitrogen-free. Fat spares the combustion of protein to furnish heat; and weight for weight furnishes, as has been shown, over twice as many calories as carbohydrates. The fat of the body is utilized in this manner as a protein-sparer. Emaciation, which bespeaks its disappearance, makes the sufficiency of food intake all the more imperative to prevent destruction of the body protein.

Carbohydrate is a very much more efficient sparer of body protein than fat. Probably much of the demand on protein in the underfed body is for the carbohydrate moiety of its structure. Carbohydrate is imperative to life and must be had at any cost. This the ingested carbohydrate furnishes, so that it both furnishes heat as does the fat, but also subserves other functions which the fat cannot do.

Nitrogen equilibrium has been struck and the subjects kept at from 5 Gm to 8 Gm days and weeks with comfort and apparent health, when enough carbohydrate and fat are taken.

The above statements hold for the protein-sparers in health. In acute infections their influence is not so marked quantitatively. Von Noorden says that in experimentally induced pyrexia the protein metabolism is not limited to the same amount in the presence of carbohydrates as when the temperature is normal.

It would seem possible, then, by covering the caloric needs of a resting patient and adding the 25 per cent. increase induced by pyrexia, to keep a patient in nitrogenous equilibrium. In an average man this would mean, as before stated, about 3,000 calories. In practice, however, it is not true; and it was for this very reason that protein loss still continued in acute infections, when the theoretical food-needs had been liberally met, that investigators in general were convinced that this loss was due to destruction of the cell substance by the poisons of the disease—"toxic destruction"—and that no diet could prevent it.

That this loss can be prevented and that such a fact impairs the theory of "toxic destruction," the elaborate observations of Shaffer and Coleman show. They prevented nitrogenous loss and the elimination of creatin and increase of neutral sulphur, which are taken as the expression of cell destruction. They found that from sixty to ninety calories per kilo were needed to effect such a result in typhoid fever. Of this amount forty to fifty or even more calories per kilo must be furnished by carbohydrates. They point out that a loss of 10 Gm of nitrogen or 62.50 Gm of protein can furnish but 250 calories, and have no explanation to offer for the fact that 2,000 calories of carbohydrate are needed to prevent this loss.

It has been proved, then, that in some men suffering from severe acute infectious disease, the usual protein loss can be stayed by the administration of a large quantity of foods.

In this chapter I have dealt only with those laws that constitute the science of dietetics. The application of these laws to the individual; the appreciation of those factors that make every individual deviate from the type; the adjustment of theory with conditions, constitute the art of dietetics.

SUMMARY

The body is a mechanism for the conversion of one kind of energy (potential) into other forms of energy, for the most part heat and work (thermo-kinetic).

Total energy may be expressed in terms of heat.

The heat unit is called the calorie.

Small calorie expresses that amount of heat required to raise 1 c.c. or gram of water through 1° C.

Large calorie equals 1,000 small calories.

The calories referred to in the text are large calories.

The calorie requirements of a man depend on his size, his age and his activities; hence his calling or occupation.

The requirements at rest (in ordinary acceptance of the term) in bed, are 33 calories per kilo of body weight or for man of 70 kilos (154 pounds) 2,300 calories.

The requirements are the same for man at rest, whether he is sick or well.

Calorie requirements per kilo are much higher in the young.

Calorie requirements per unit of body surface are much the same at all ages.

ARRANGEMENT OF DIET IN ACUTE INFECTIOUS DISEASES

1. Provide as a minimum the calories demanded by the individual at rest; i.e., for adult man 2,300 calories.
2. Provide enough protein to replace wear and tear; i.e., for an adult 65 to 80 grams.
3. Add to calories demanded at rest the amount required by extra heat production of fever; on an average 25 per cent. rest requirement; i.e., for adult total of 40 calories per kilo or 2,800 to 3,000 calories.
4. Add calories, especially in form of carbohydrates, to shelter proteid loss. May require 60 or more calories per kilo. Amount determined by loss or gain in weight, i.e., 4,000 or more in total.

Proteid Needs.

Voit's standard 118 grams.
Actual need shown by Chittenden to be less by nearly one-half.

Functions of Proteid.

1. Storage of nitrogen, in growing child, in pregnancy, in lactation, in hypertrophy of muscles from exercise, and in convalescence from disease.
2. Repair—wear and tear of day.
3. Fuel—proteid is not an economic fuel because of high "specific dynamic action."

Milk.

Analysis. Fat, 4 per cent.; sugar, 4.5 per cent.; proteid, 3.5 per cent.

Caloric value, 700 to 1 liter.
620 to 1 quart.
20 to 1 ounce.

Proteid content, 35 grams to 1 liter.
32 grams to 1 quart.
1 gram to 1 ounce.

Not well balanced for sole article of diet.
Disturbance of gastro-intestinal function slight at beginning of fever.

Fever.

Ordinary use of term connotes effects of 1. pyrexia. 2. toxemia.

Pyrexia.

Increases caloric demand even up to 50 per cent. Average, 25 per cent.
Toxemia accelerates destruction of body proteid; demands high calorie intake to prevent it.

Starvation.

Inflicted on patient by insufficient diet.

Feeding. Early in fever anorexia is a conservative symptom and to be respected.
After first few days gastro-intestinal functions are competent and food should be administered to meet needs.
Water needs are high in fever. It should be given freely.

CHAPTER III

ACUTE RHEUMATIC FEVER

Theories of Rheumatism. It is not my purpose to discuss the numerous theories advanced to account for the phenomena of acute rheumatic fever. I will merely state that it is the consensus of opinion at the present time that the disease is an acute infection. Numerous observers have claimed to have isolated the specific organism, among the most insistent of whom are Poynton and Payne.

Etiology. The classification of this "specific" organism has not as yet been fairly settled; indeed, the identity of the "specific" organisms is much in question. Some believe, moreover, that different organisms can produce the same clinical complex called Rheumatic Fever and one observer, Rosenow, maintains the transmutation of members of the streptococcus group into several forms, each inducing some differences in the clinical picture. This will be touched upon again when discussing vaccine therapy. To Poynton's view has been lent the weight of the authority of Osler's new *Modern Medicine,* to the pages of which he contributes the article on rheumatism, and in which the various views of the etiology of this disorder are set forth in some detail.

Age. About one-half of all cases of rheumatism occur between the ages of fifteen and twenty-five years; about one quarter in the next decade, that is, between twenty-five and thirty-five years. My own impression, based on considerable contact with children, is that the figures set for childhood are too low, as the disease is peculiarly insidious at this age, and deviates strikingly from the type as established in the adult. The serious complications are quite as common, even more common than in the adult. Of the cases occurring in childhood, 70 per cent. fall between the ages of ten and fifteen years.

I cannot refrain from intercalating a bit of pediatric wisdom at this juncture: (1) Beware of a diagnosis of rheumatism in infancy. It is so rare that, when authentic, it warrants rushing into print, which is saying a good deal. The so-called rheumatic joints of infancy are almost certainly pyogenic, scorbutic, or syphilitic. (2) Scan every child's heart with care, and seek constantly in the histories for tonsillitis, stiff neck, and especially "growing pains." How many children's lives have been sacrificed to that unfortunate term no man can estimate.

How readily rheumatism in children may be overlooked is shown by Langmead who, examining 2,556 English schoolchildren, found that 5.2 per cent. of them showed evidences of rheumatism and 4.49 per cent. of them in terms of heart disease.

While this percentage is larger than one would, in all probability, find among our children, still among 1,000 children coming to my clinic at Bellevue Hospital just 1 per cent. showed valvular heart disease, for the most part unrecognized.

Symptomatology. That the disease is rather abrupt in its onset, accompanied by fever, that sore throat is not uncommon, that drenching acid sweats may occur, and that the inflamed joints are the pathognomonic sign, is all well known, and is reiterated here merely to emphasize the points of attacks in the application of therapy. The complications are the important events in the course of rheumatism, and will be considered after rules have been laid down for the simple, uncomplicated case.

Therapy. A sick man invites medical attention for two reasons: First, he wants to be cured of his disease; and second, he wants to be made more comfortable during his illness. To treat a patient intelligently, it goes without saying that a diagnosis is imperative, but the intellectual satisfaction derived from establishing a diagnosis must not lead to a satiety that eschews further effort directed toward relief of the condition. Such a comment is justified by fact. Still another function to be subserved by the physician is the instruction of the patient how to avoid a repetition of the attack. There are certain measures that may be directed toward any acute illness, others that are aimed at the particular disease in question. This order will be preserved.

Rest. In the rheumatism of adults the painful condition of the joints impels rest, willy-nilly, but this by no means obtains in children. Pain, which he who suffers it looks upon as an unmixed evil, is more often a boon than a bane. If one will get in the habit of analyzing the symptoms of disease in terms of efforts on the part of Nature to accomplish a useful purpose, or as expressions of compensations, he will be amazed to see how many hints these symptoms give that they are to be utilized as allies, not combated as enemies.

In rheumatism there are three emphatic reasons why rest should be insisted on: (1) Because the body cells are busied in combating an intoxication, for which their energy should be conserved as much as possible; (2) because certain tissues are undergoing the alteration incident upon inflammation, and are struggling to accomplish repair; and (3) because the spectre of cardiac involvement is never absent from the disease, and we fear that every increment of activity on the part of that organ may heighten the possibility of the dreaded disaster.

To illustrate the significance of rest, I will cite the following figures: One knows, as a fundamental physiological fact, that the energy and heat of the body are derived from the combustion of the foodstuffs, and that the carbon of these foodstuffs is in large measure eliminated from the body through the lungs as CO_2; so we can collect and estimate the amount of CO_2 eliminated in a unit of time, and look upon the results as expressions of the activity of the body cells during that period. This has been done repeatedly, and the same individual who during sleep eliminates 22 grams of CO_2 per hour will, when awake and exercising the greatest amount of muscular relaxation possible, eliminate 31 grams, and under conditions ordinarily considered those of rest, 38 grams. In this light, rest assumes a meaning, and the importance of restlessness and loss of sleep in disease is enhanced in dignity.

The two important factors to be considered in estimating the amount of work done by the heart are the amount of blood expelled and the pressure, that is, resistance, to be overcome. The lessened heart rate in recumbency and the diminution, even though moderate, of blood pressure in this attitude will suffice to emphasize the importance of rest to this organ.

Rest should be in bed. One might suppose this injunction to be superfluous, and yet it is every one's experience not infrequently to find himself in the presence of contentious individuals who demand many reasons, when it might be supposed common sense would dictate; and one might as well write in golden letters on the tablets of his memory that he is to treat individuals, whose very individuality depends on differences, not machines nor yet diseases.

Bed. The bed should be of a height and width most convenient for handling the patient, who is in many instances helpless, and to whom the most gentle handling may constitute torture. A half, or at the most three-quarter bed, with a woven wire spring, sufficiently stiff to prevent sagging, should be chosen. The standard hospital bed is an admirable example. The mattress should be soft, but resilient and firm. A good hair mattress is preferable. If the patient perspires freely, the bed should be made with thin blankets instead of sheets. The patient should wear a thin flannel nightgown, opened all the way down the front and slit along the sleeves, so that the joints may be exposed for inspection or treatment with the least disturbance, and it is well to throw a thin flannel cape about the shoulders. The nurse should be instructed to put the clothes on this bed with a view to the comfort of the patient, rather than to preserve the symmetrical and esthetic effect so often insisted on in the hospital ward, regardless of the comfort of the patient. Often the lightest touch of the clothes is agonizing to the patient, and hoops, cradles, or other contrivances to take the weight of the clothes off the patient must be utilized.

Room. The best available room should be chosen, with a view to an abundance of light and air, with a southern exposure in the winter, and away from the prevailing winds at all times. The bed should be so placed that the draughts may be avoided but the air not shunned. The therapeutics of light is not duly appreciated. The minds and bodies of many of us are as responsive to its influence as a photographic plate. Air should be admitted to the room freely. There can be no superfluity of fresh air. In summer the windows should be kept wide open. In the winter the room should be frequently aired and kept at 65° to 70° F. Personally, I do not hesitate to admit the cold clear air of a winter's day to the sick room, observing proper precautions with reference to the patient's coverings.

Diet. If there is any one field within the province of medicine that promises richer yield than another for the labor expended on it, it is that of dietetics. As yet it is almost virgin, and still such results as have been obtained are of the highest significance. It has been well suggested that if the physician would give the same amount of time, work, and care to the prescription of foods that he does to drugs, enormous benefit would accrue to his patients.

In the first place, a sick man needs food, and he needs more food than is ordinarily given him. Of course, one grants that there are certain conditions that make the administration of sufficient food difficult or impossible, but that does not obtain in the majority of instances.[1] As I have said, the energy and heat of the body are derived from the combustion of its foodstuffs, and as energy can be converted into heat, the value of the foodstuffs can be expressed in heat units. Moreover, the amount of energy and heat the body gives off in a day can be measured in terms of heat units; so that we can determine just how much food an individual of a given weight, under varying conditions of activity, needs. The term adopted to express a heat unit is the "calorie." The amount of heat that 1 calorie represents is that required to raise 1 kilogram of water from 0° to 1° C. This calorie is sometimes spoken of as the "large calorie." The "small calorie" is the amount of heat needed to raise 1 gram of water through 1° C. of heat; therefore, 1 "large calorie" equals 1,000 "small calories." Unless qualified, the term "calorie" means a "large calorie."

Now, under what is ordinarily known as rest, a man gives off heat in twenty-four hours equivalent to about 33 calories per kilo of body weight; that is, a man weighing 70 kilos, or 154 pounds, will give off about 2,300 calories. This amount of heat must be replaced by his foodstuffs to keep him in equilibrium.

The patient with rheumatism, however, is suffering from fever, and in fever he gives off not only what he does in health at rest, but some 20 to 30 per cent. more. If we add 25 per cent. more to our estimated calories at rest, we find the patient's needs are 2,800 to

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[1] See Chapter II, *Diet in Acute Infectious Diseases.*

2,900 calories. We are all aware that in febrile conditions it is customary to put a patient on a milk diet, because the different food constituents—fat, carbohydrates, and proteids—are so well represented in it, because its proteid furnishes all the elements, amidobodies, "building stones," necessary to the construction of body proteid (which is not true of all food proteids), because it is bland, and because it is easily administered. The physician's instructions frequently are a glass of milk every two hours. A glass is supposed to hold 8 ounces; more commonly, as given, it holds 6 ounces. On this schedule, ten feedings would be exceptional, and eight nearer the actual number; so the patient would get 1½ to 2 quarts of milk a day. In a quart of milk there are 620 calories of food; in the patient's dietary, 930 to 1,240 calories, or one-third to two-fifths of his needs as calculated. But the case is even worse than this, for, as I have shown, there are reasons why, in fever, a patient's dietetic needs are greater than those set out above.

It is an easy mathematical problem to determine that to meet the patient's caloric needs with milk would require some 5 quarts of milk, and the administration of over a gallon of milk day after day does not appeal to our common sense.

Moreover, this amount of milk would contain 128 to 160 grams of proteid, which is excessive.

To keep within quantitative limits, qualitative changes must be made in the food. The readiest way to do this is to add to milk, cream to furnish more fat, or starch, or sugar, to furnish more carbohydrates. For example, enough milk sugar can be added to the milk to make 10 per cent. without making it disagreeably sweet; or cereals, to make gruels or milk soups. Six per cent. of sugar added to milk will give a milk equal to about 860 calories to the quart.

In addition to milk, cereals, bread and butter, rice, and cereal or milk soups are permissible. An ordinary thick slice of white bread (1⅓ ounces) furnishes 100 calories; an average pat or ball of butter (a little less than ½ ounce) the same; an ordinary helping of boiled rice (4 ounces) as much more, and 1½ to 2 ounces of cream the same. Even 3 teaspoonfuls of granulated sugar affords 100 calories. There are 100 calories in a large serving of oatmeal or hominy.

This necessity for a sufficient diet obtains especially in long-continued fevers, while in the brief fevers of intense character, in which the functions of the digestive organs are impaired, only small amounts of food are to be urged, as the body has a surplus to meet its needs for a short time.

I have introduced these figures to concentrate attention on a branch of our art that has been left too little cultivated and exercised without reason. Milk, milk soups, cereals, bread, and rice form the staple diet in rheumatism. To meat soups, which have scarcely any nutritive value, there are certain theoretical objections, but if their well-known influence in spurring a jaded appetite and stimulating what the Germans call the "appetit-saft," is taken into consideration, I think their administration in small amounts is warranted. With the decrease in the fever, eggs may be used, and in convalescence, fish, meats, and vegetables.

Bowels. When called to attend a patient suffering from an acute infectious process, it is a good rule to assure satisfactory evacuation of the bowels. Just how much additional disturbance a neglect of this measure may induce we do not know, but we are aware of the fact that at times in an individual otherwise well, constipation may incite symptoms akin to acute intoxication, or more commonly, depression, malaise, anorexia, and headache, and we have evidence that products of decomposition in the bowel, normally absorbed and paired, like the indol group, with sulphuric acid, can, when this function of pairing is interfered with in disease, give rise to toxic manifestations.

An active saline, like magnesium sulphate or **Epsom salts,** sodium sulphate or **Glauber's salts,** or sodium potassium tartrate or **Rochelle salts,** in doses of 1 **ounce,** or, in patients susceptible to saline purgatives, ½ ounce, may be given, assisted by a **soapsuds enema** four to six hours later, if the salts have not been sufficiently effectual.

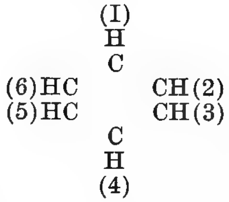
It should be remembered that the feces represent an excretion from the bowel of mucus and other substances which represent nitrogenous metabolism, as well as a large content of bacteria, and afford a pretty constant percentage of the total nitrogenous output; that the feces are not mere food residues, and, in fact, normal feces should contain but very little food residue other than indigestible fibers of cellulose, seeds, etc. Hence it is surprising to the patient, and often to the physician, too, to discover so large results from catharsis when the patient has been on a milk diet, or even when on no diet at all. With this knowledge, then, of the formation of feces with a low or easily digestible diet, the necessity of attending to periodical evacuation is emphasized. This may best be done by enemas in most febrile diseases, but with the discomfort incident upon handling the body in rheumatism, further doses of salines may be preferred. I believe that too frequent catharsis by drugs entails an irritation that in itself may become mischievous.

Avoidance of constipation is imperative while administering salicylates as this precaution lessens the probability of acid intoxication from the drug.

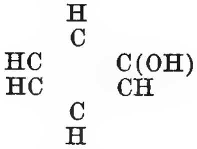
Specific Treatment. It was once hoped that every disease might be met by a specific drug, and it was once believed that many diseases were cured by specific drugs; but as medicine entered on an era of more searching observation, and had to rest its judgment on scientific criteria, the number of specifics dwindled, until "specific" treatment has come to connote the treatment of one disease alone, syphilis.

The Salicylates. When Dr. Maclagan, of Edinburgh, in 1874, began to use salicin, a glucoside of salicylic acid, obtained from the young bark of the willow, in rheumatism, which was quickly followed by the introduction of other forms of salicylic acid, the change that came over the clinical picture of this disease, that turned a bed of racking pain into a couch of relative comfort in a few hours, and a patient to whom the least touch was agonizing into one who could be handled with relative impunity, warranted the belief that a specific had, indeed, been discovered. It is said that we no longer see rheumatism as it was presented to the older practitioners, and yet the drug cannot be called specific, if we mean by that one that can eradicate the disease. That its discovery was a boon, no one who has witnessed its effects can for a moment doubt.

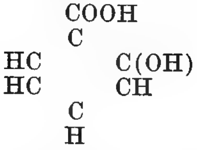
Salicylic acid has this structure:



is the benzine ring. If you will replace the H at (2) by an –OH group, that is, make an alcohol of it, you will convert it into a well-known poison, carbolic acid.



Note what slight changes in a complex group and the introduction of what simple radicles induce potent changes in character. We have but to make another slight change, by introducing an acid radicle at (I), to convert the toxic carbolic acid (which is no acid at all, but an alcohol) into the substance in question, salicylic acid.[1]



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[1] Salicylic acid is not derived in this manner, but from ortho-oxy-benzyl alcohol, $HO.C_6H_4.CH_2OH$. The Illustration is used to draw attention to the chemical kinship of well known drugs which are so different in their action.

I might add that the introduction of an acid radicle into the structure of a toxic alcohol detoxicates it. This is a general law.

This substance is classed among the antipyretics and antiseptics; it is also an anodyne. Its therapeutic value is exercised in all three directions in rheumatism. Salicylic acid should not be administered as such, but in the form of a salt or ester. The effect is the same in kind in all these forms, but certain by-effects determine the use of one or the other. It should be administered in full dose. Its failure may often be attributed to insufficient dosage. Its toxicity is slight. In an adult of average weight I give as much as **20 grains** (1.30 Gm) of one or the other form of the drug **every two hours** for the **first twenty-four** hours during the waking period, **or even for forty-eight hours. In severe cases even 30 grains** (2 Gm) may be given for the **first two or three doses.** As the pain subsides the dose may be cut down gradually to **15, to 10** (1.–0.60 Gm) **grains at a dose,** how much and how rapidly depending on the progress of events or on signs of toxicity. The dose should be well maintained at amounts of 10 grains (0.60 Gm) every two hours until the active phases, as evidenced by fever, pain, and joint swelling, have passed. Just how this drug acts in rheumatism we do not know, but its effects are so much more prompt and satisfactory in this condition than in any other clinically akin to it, that we are impelled to believe that it has some effect on the materies morbi directly; so that, it is my custom to keep the patients on considerable doses—5 to 10 grains (0.30–0.60 Gm) every two or three hours for a week or ten days after the subsidence of acute symptoms, and for four to six weeks on lesser doses of 5 or 10 grains (0.30–0.60 Gm) three or four times a day, administering the drug much as we do quinine in malaria.

If satisfactory results do not follow these doses they may be pushed to the production of toxic manifestations.

Hanzlik's studies of the toxicity of the salicylates carried on at the request and under a grant from the Committee on Therapeutic Research, Council on Pharmacy and Chemistry, American Medical Association, showed that the toxic dose of Sodium Salicylate in the majority of individuals of both sexes lies between 100 and 200 grains (the mean toxic dose for males nearer 200, for females nearer 150).

These figures are close to my customary dosage.

The dosage for children should be relatively large and may be pushed to toxicity, even in cardiac disease.

The tendency is to give to children too small a dose rather than too large. When men of large experience, like Lees in England, give 200–400 and more grains a day to children under sixteen years, it will be appreciated how far short of the danger-mark, if not of efficiency, our usual dosage is.

With this drug, to prevent acidosis, one should administer an alkali. I prefer bicarbonate of soda of which something more than grain for grain should be given; my rule at the beginning is 2 grains of bicarbonate to one of the salicylate.

The toxic symptoms, except such as constitute an idiosyncrasy are disagreeable rather than dangerous or disagreeable long before they are dangerous, giving ample warning to watch or to stop or modify the dosage.

They are: (1) buzzing, roaring in the ears, with varying degrees of deafness, headache; (2) gastric disturbances, more rarely; (3) cardiac disturbances; (4) respiratory disturbances; (5) cerebral symptoms; (6) renal complications; (7) hemorrhages; and (8) skin involvement. This looks like a formidable array of disasters, and so do tidal waves, cataclysms, and the fall of meteors in the catalogue of everyday possibilities; but, like most apparitions, this list takes less substantial proportion when submitted to light. I will consider them in the reverse order. Skin eruptions after the use of the salicylates are rare; still a diffuse erythema, an urticaria, a hemorrhagic outbreak, and other forms may follow. It will be observed that the three forms specified have all been associated with rheumatism, and it would be difficult to determine in all cases the association of the drug with the rash. They are not dangerous in themselves, and the drug should not be intermitted on their appearance unless clearly aggravated by the continuance of the drug.

Retinal hemorrhages are still more uncommon, while epistaxis and other hemorrhagic manifestations have been more frequently reported, and, if severe, might enforce cessation of the drug. Albuminuria and hematuria, which have been attributed to the irritating effects of salicylates, may be and probably are caused by the disease itself, but with their appearance it might be wise to intermit the treatment until it is demonstrated that they do or do not play a part in the disturbance. There can be no doubt that now and then the salicylates have induced an active delirium, sometimes like an acute mania. I recall a report of two such cases occurring at Bellevue Hospital, but it is very unusual. It must not be forgotten that delirium intervenes in the course of rheumatism, especially, it is said, with the onset of a pericardial involvement, and associated with hyperpyrexia. Dyspnœa, characterized by slow and labored breathing (see below), has occurred, and suggests the possibility of impurities in the drug, as, indeed, does the slow heart and threatened collapse occasionally noted. Here, too, one must keep in mind the involvement of the myocardium, the lung and the pleura, in the disease. However, in either instance, so threatening a condition should indicate a withdrawal of the drug.

I have recently seen four cases of bradycardia and arrhythmia in rheumatism and have shown them to be due to a sino-auricular block.

This disappeared with the intermission of the salicylate and reappears with its resumption. No evidences of circulatory embarrassment were seen in these cases. Dyspnœa should suggest acidosis from the drug, and the urine should be examined for acetone bodies.

To sum up, I should say that the above-mentioned conditions are rare; that they may be attributable in most instances to the disease rather than to the drug, or to idiosyncrasies—those peculiar reactions of the individual to drugs, food, and environment that takes him out of his class and constitutes in him an anomaly, and defies foreknowledge. I firmly believe that it is only a minority of the above-mentioned conditions that can be attributed to the drug itself.

It stands otherwise with the first two disturbances enumerated. They are to be attributed to the drug, and their occurrence modifies our action. The ringing in the ears and a mild grade of deafness may be looked upon as a limit of tolerance with comfort rather than a menace. There is no reason to intermit the drug on this account, but if the discomfort is considerable, the dosage should be cut down or stopped. The gastric irritation resulting upon the administration of salicylates is the *bête noir* of the practitioner. It is for this reason rather than for any other that so many forms of salicylates are in use. There are certain forms of the drug from which one may anticipate more irritation than from another, but, again, the susceptibility of a particular stomach to a particular preparation cannot be predicted with any degree of assurance.

I advise, as a rule, the use of the preparation that has stood best the test of time and experience. In this case it is the sodium salt of the acid, **sodium salicylate.** I may say at once that the acid itself is too irritating to administer internally. Order the drug alone, in simple solution. Order the dose to be taken well diluted.

For example, write thus:

℞—Sodii salicylatis		15.0	℥ ss
Aquæ destillatæ	q.s. ad	60.0	℥ ij

M. et S.—One teaspoonful in water every two hours.

One will note that this calls for a 2-ounce mixture, but, if written in the metric system, that there are just as many grams in this 2-ounce, or 60 c.c., mixture as we want to give grains in one dose. Even the water has as many cubic centimeters as we want to give drops in a dose—60, that is, 1 teaspoonful.

Sometimes the salt is better borne and less disagreeable to the taste if a little glycerin is used, as:

℞—Sodii salicylatis		15.0	
Glycerini		15.0	āā ℥ ss
Aquæ destillatæ	q.s. ad	60.0	℥ ij

M. et S.—One teaspoonful in water every two hours.

If one has doubts about his patient's ability to get a good salt, he should order the salt made fresh from salicylic acid by adding sodium bicarbonate. This is a very excellent way of writing the prescription:

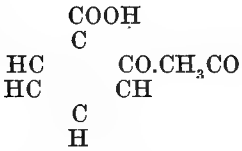
℞—Acidi salicylici	15.0	℥ ss
Sodii bicarbonatis	q.s.	q.s.
Aquæ destillatæ .... q.s. ad	60.0	℥ ij

M. et S.—One teaspoonful in water every two hours.

The druggist is to use of the soda what is needed; he adds definite proportions of the two drugs, if he follows the Pharmacopœia, or he simply adds soda to the solution of the acid until effervescence ceases; that is, until no acid is left to liberate the CO_2 from the soda.

In the early days of the synthesis of sodium salicylate a good many impurities existed which made such a prescription as was just cited a wise precaution, but Hilprit's study of the different synthetic sodium salicylates at the instigation of the Council of Therapeutic Research of the A. M. A. show that such impurities no longer exist and that their "investigation would seem to warrant the conclusion that the cheapest commercial synthetic sodium salicylate is the equal of the higher priced brands of the synthetic kind or costly natural product."

If, for any reason, sodium salicylate is not well borne, one may have recourse to another form of the drug. My own preference is for **aspirin**, which is an acetylsalicylic acid; that is, it is salicylic acid in which the H of the OH group has been replaced by an acetic acid radicle, CH_3CO; thus:



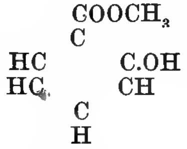
$$\begin{array}{ccc} & \text{COOH} & \\ & \text{C} & \\ \text{HC} & & \text{CO.CH}_3\text{CO} \\ \text{HC} & & \text{CH} \\ & \text{C} & \\ & \text{H} & \end{array}$$

This substance is a white powder, formed of small crystalline needles, practically insoluble in water (100 parts) and in acids, so that it passes through the stomach for the most part unchanged, and is broken up in the intestine. It is less irritating to the stomach, but that it should be devoid of all the disadvantages of the sodium salt its chemical structure forbids us to believe. I have in one instance seen a massive angioneurotic œdema of the face follow a single small dose, and have seen such cases reported in the literature since. However, I believe it to be a very valuable form of salicylic acid. It is best prescribed in capsules. The dose is practically the same as the sodium salt, or about 15 grains (1.0 Gm) for a beginning dose.

The Committee determined the mean toxic dose of aspirin to be a little smaller only than that of sodium salicylate, i.e., 165 grains a day for adult males, 120 for females.

Alkaline salts must not be given at the time of administration as they are incompatible with the drug, but should be given between the doses.

Another excellent preparation of the salicylic acid series is the ester, **methyl salicylate,** that is, salicylic acid in which the H of the acid group is replaced by methyl CH_3; thus:



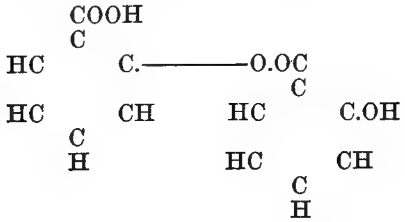
Methyl salicylate is a volatile oil that constitutes well over 90 per cent. of the **oil of wintergreen,** the well-known gaultheria procumbens of our woods, and of the oil of birch, oleum betulæ, obtained from the bark of the sweet birch, betula lenta, or is produced synthetically, and when carefully prepared should answer the purposes of the natural oils. Of the three, the oil of wintergreen is, as a rule, preferred. It may be given in capsules, in emulsion, or in milk. I very much prefer the capsules, because in emulsion the decided taste of the drug, which may be agreeable at first, soon palls on the patient.

As for its administration in milk, the same objection obtains, and what is much more important, it violates a rule that I believe one should invariably observe—never give medicine in food, for, if the medicine does disagree, its association in the mind of the patient with the food may produce a disgust for food which may be the mainstay of the case.

The Committee's research placed the mean toxic dose as 120 minims of the oil of gaultheria.

The drug is usually very well borne, but its decided taste, even when given in capsules (for the slight eructations it often induces is a constant reminder) is the chief drawback.

Diplosal is a form of salicylate more lately come into use and as its name suggests contains two salicylic acid radicals; that is, it is a salicylo-salicylic acid or salicylic ester of salicylic acid, formed by the condensation of two molecules of salicylic acid, the H of the acid radical of one molecule being replaced by the second molecule entering by its phenol group (OH) at (1); thus:



It is an insoluble powder and like aspirin is little affected by acids, so is supposed to pass the stomach unchanged and like the aspirin is broken up by alkalis.

It is best given in capsules and alkali should not be given with the dose but between the doses.

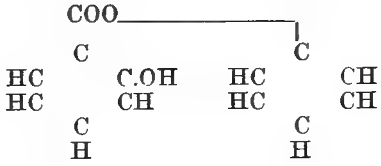
It has the same toxic effects as other salicylates and is given in about half the dose of sodium salicylate.

Hanzlik's studies showed the mean toxic dose per day was 100 grains for adult males and 83 grains for adult females.

I have had but little experience with this particular form of salicylate.

One will rarely have to choose outside of one of these four forms of salicylic acid in the treatment of rheumatism. If he does, the great probability is that he has not administered these forms properly, or that the patient cannot stand salicylic acid in any form, or that the series does not meet the needs of this particular case.

I will mention two other well-known preparations: First, the original drug, **salicin.** This is a glucoside, which can be split up by acids into grape sugar and saligenin, the active principle, which is the alcohol from which salicylic acid is formed, and this formation of the acid goes on in the body after its administration. It is a white powder, bitter to the taste, rather insoluble in water (28 parts), so best administered in capsules. It is well borne, and by many preferred for children. The dose is the same as for the others. Second, **salol,** another ester, phenylsalicylate, that is, salicylic acid in which the H of the acid group is replaced by phenyl C_6H_5; thus:



It is a white powder, almost tasteless, and quite insoluble in water. It passes through the stomach for the most part unchanged, and is broken up in the intestine, two-thirds of it appearing as salicylic acid and one-third as carbolic acid. It is administered best in capsules or powders, or can be suspended in mucilage of acacia. It has no advantage over the other forms in rheumatism, and has the disadvantage of affording only two-thirds of its weight as the desired substance, while one-third is the toxic carbolic acid, which can produce its characteristic poisonous symptoms when given in large doses. The dose is about the same as for the other preparations.

As I have already intimated, some patients cannot take salicylic acid in any form. We cannot, for that reason, neglect their need for relief of pain. The three drugs in most common use for such a purpose are **acetanilid** (antifebrin), **antipyrin,** and **phenacetin** (officially acetphenetidinum). Of these three, the first is the most potent, also the most irritating and toxic. These drugs are not given over a long period, as the salicylates are, but as needed, to control pain. Often small doses, frequently repeated, are as efficacious as fewer large doses. Acetanilid may be given in doses of 1.5 grains (0.1 Gm) every half hour for four doses, or 2 to 3 grains (0.15–0.2 Gm) every two hours. If there are heart complications, it should not be used. Phenacetin may be used in twice the dose. The dose of antipyrin lies between the two. These drugs should be promptly stopped if cyanosis appears, which is well before cardiac or respiratory failure threaten, and, of course, as soon as pain is relieved.

If the pain is severe, rather than push these coal tars to large doses, one should use **morphine**, in small doses, hypodermically, ⅟16 to ⅛ grain (0.004–0.008 Gm). Morphine in any illness of length should be used reluctantly and in minimum dose, lest a habit be established. Two other drugs have been much used to control pain—potassium iodide and colchicum. Their bad effects on the stomach are too certain, and their beneficial effects on the condition too dubious, to encourage their use.

Another line of treatment, originated in England by Fuller to combat an acidity that at that time was looked upon as an etiological factor in the disease, is the "alkaline treatment." This treatment met with little favor elsewhere in Europe, but was adopted in this country to a considerable extent, and still has some vogue. By many men it is used when the salicylates are not well borne; by others when cardiac complications threaten or exist; and by a very great many in conjunction with the salicylate treatment.

This empirical usage is probably due to the avoidance of acidosis when alkali is combined with the salicylic acid used and to such diuretic effects as the salts may have.

One should choose the milder alkalies—sodium bicarbonate, potassium citrate, or potassium acetate; for example, 2 grains to 1 of salicylate until the urine reacts alkaline, and then in a little less dose, or enough to continue the urine alkaline.

Acidosis. When we use these large doses of the salicylates we should keep in mind the danger of acidosis and take measures to prevent it.

The symptoms of acidosis are drowsiness, vomiting, air-hunger (dyspnœa) and delirium. The confirmation of the suspicion aroused by any of these symptoms is found in an examination of the urine and the discovery of acetone bodies. Attention has been called to the fact that the picture is that of an early tuberculous meningitis rather than acidosis and I myself have seen the same picture in the common acidosis of infancy and early childhood in the child of a physician whose diagnosis was tuberculous meningitis.

The preventive and, indeed, symptomatic treatment is a sufficiency of alkalis; my rule being two of the bicarbonate of soda to one of the salicylates.

Miller of London lays great stress upon constipation as contributing in some obscure way to acidosis when the salicylates are taken. He maintains that during constipation even so small a dose as 15 grains a day may cause acidosis and that during constipation even 2 to 1 of alkali may not prevent it.

Vomiting. Miller studying vomiting in children taking salicylates found it severe in only 10 per cent. of the cases and what is of great importance that two-thirds of these had severe cardiac dilatation, and drew the conclusion that vomiting depended less on the dose than on involvement of the heart and that the more severe the heart affection the less the salicylate required to induce vomiting.

It must be remembered that vomiting may be the symptom of cardiac involvement when no salicylates are taken and that cardiac involvement does not contra-indicate the use of salicylates, but it is well to divide the total day's dose into smaller and more frequent dosage, or use the rectal or intravenous methods.

Rectal Administration of the Salicylates. Heyn of Cincinnati called attention to this mode of administration in 1912. I have used it with trivial modifications with most gratifying results over a long period of time.

The essence of the procedure is to give the drug in suspension in starch paste with enough opium to lessen rectal irritation and assist in retention. Give a cleansing enema.

Technique. Make a thin starch paste—use it at body temperature. Take 4 to 6 ounces (not an amount too large to be retained readily) and add to it ½ to total daily dose, say ʒi–ij (4–8 Gm) of the sodium salicylate in powder and one or two minims (0.06–0.13 c.c.) of the tincture of opium. Inject gently into the bowel and hold the buttocks together for a few moments. Repeat at 12 hour intervals.

Instead of dividing the dose one may give the whole dose in one daily injection.

The amount of salicylates used depends on the same consideration as when given by mouth, i.e., to the point of efficiency or toxicity. The amount of starch—enough to carry the drug and not provoke a movement.

The amount of opium—the least to effect retention.

Alkalis (bicarbonate of soda) should be given in same amounts by mouth as if the salicylates were so administered.

Intravenous Administration. Still another method of administering salicylates, the intravenous, I recommend on the advocacy of my colleague, Conner, of New York, although I am entirely lacking in personal experience with it. Conner does not urge it in preference to the more time-honored mode of administration, but in those cases where success has not followed the latter or the stomach rejects it. I simply quote in substance and largely in words his technique as published in *The Medical Record,* February 21, 1914.

The drug chosen is a chemically pure crystalline sodium salicylate dissolved in distilled water (preferably recently distilled) which has been freshly sterilized by boiling, to a 20 per cent. solution. Such a solution will keep well several days if protected from the light and will remain colorless.

A rubber ligature is placed around the arm tight enough to obstruct the venous flow, making the veins at the bend of the elbow stand out prominently. The desired result is more effectually attained if the arm is allowed to hang down and the fist is opened and closed.

The skin over the vein is then sterilized by painting with Tincture of Iodine. The best syringe to use is one made entirely of glass, holding 10 c.c. and supplied with a *fine* (small, bright, sharp) hypodermic needle. These, of course, are sterilized.

The arm is extended fully and fixing the vein below by pressure with the left thumb, the operator thrusts the needle into the vein in the direction of the venous flow, and makes certain of entrance into the vein by drawing a drop of blood into the syringe; and then injects. Pressure is made for a moment over the site of the injection to prevent leakage of blood into the subcutaneous tissue and the iodine washed off with alcohol.

Fifteen, 20, or even 30 grains are given at 12 or 8 hour intervals. No unpleasant effects were met with in Dr. Conner's experience, even after 120 grains a day.

The relief from pain is striking and prompt and the stomach is not upset.

The same vein can be used again and again, provided a small clean needle is used.

Symptomatic Treatment. The symptoms that give character to this disease are those referable to the joints. The improvement in the local manifestations of the disorder under salicylates constitutes one of the most satisfactory evidences of their potency, and yet the resolution of these parts often lingers well behind the disappearance of the fever and the pain; and, moreover, much can be done during the height of the disturbance to ameliorate the discomfort, hasten the resolution, and prevent bad sequels.

Rest. For an inflamed joint, just as for a broken bone, rest is imperative. Pain, which I have said is Nature's agent, impels rest, but when pain is banished or mitigated under our ministrations, the patient uses the joint too early, and often to his great detriment. The position of the limb in semiflexion is one involuntarily chosen as the most comfortable, and may be preserved during the acuteness of the attack. Various devices are used to maintain a single position. We can bolster the limb by putting pillows under the knee or on either side, and find similar arrangements for the other joints. This, of course, cannot assure a high degree of immobility, and we can secure better results with splints, well padded and carefully applied. The success of these devices depends on the care and skill with which they are applied, and if simply suggested by you and left to the devices of unskilled hands in the application will be far worse than useless. Still another way to attain the desired end is by applying stiff bandages of plaster-of-Paris or starch. Again, much care must be taken in the application, as the parts cannot be daily inspected, and rough folds in the bandage, bits of dried plaster next the skin, which is moist with the excessive perspiration, can induce sores of serious import. These casts must be reapplied as the effusion in the joint disappears.

In a considerable experience with rheumatism, I have very rarely had to have recourse to splints.

Heat and Cold. The patient's testimony is sufficient evidence of the comfort these measures afford, whatever opinion may be entertained with reference to their curative qualities and the rationale of their action. From the standpoint of comfort the reaction of different patients to heat or to cold differs widely. To one patient, with a painful joint, cold gives almost instant relief, while in another the pain is intensified, and finds relief from heat, and vice versa. Continuous cold exercises considerable anesthetic effect, and may be secured by the application of the **ice coil,** or the more readily obtained and manipulated **ice bag.** Ice bags of various shapes may be obtained, but the circular ice bag does well for most purposes. The ice bag must be properly filled in order to make its application efficient. The ice should be cracked in pieces not larger than the end of one's thumb, and enough to cover the bottom of the bag. Enough cold water is poured on this to enable one to force all the air out of the bag and screw the cap down to the level of the water. This procedure leaves the bag supple, so that it may be wrapped around the part, which the presence of air makes impossible. Protect the part with a thin layer of vaseline or oil and a thin layer of cloth. A long-continued direct application of ice to the skin may do damage to that structure. Heat is best applied by fomentations. A couple of layers of flannel are wrung out of boiling water in a wringer made of a crash towel, and applied snugly to the joint. This is repeated three or four times, at intervals of ten to fifteen minutes. The parts are then sponged with water at about 75° F., and wrapped in flannel or non-absorbent cotton. A soothing application is the **cold compress.** This is done by wringing two or more layers of linen or old cotton cloth or cheesecloth out of water at about 60° F. and applying snugly to the part. This in turn is covered by dry flannel.

These applications are renewed about once an hour. The effect of cold is momentary; the vessels soon dilating and conveying heat to the surface, warm the compress to the temperature of the part drying it. The reaction induces a hyperemia, the value of which will be touched on at some future time. The joints should at all times be well protected from changes of temperature. This is best done by wrapping them in layers of non-conducting material, like flannel or non-absorbent cotton or cotton batten. The number of drugs that have been used locally are legion. I will purposely refrain from mentioning more than one or two that I have found helpful. Perhaps the most common application is **methyl salicylate.** That it does any more than any other volatile oil, by inducing a hyperemia, I doubt. That the salicylates may be absorbed by the skin I have proved to my own satisfaction, but not in such amounts as to make that the object of the application. The methyl salicylates may be applied pure, or in the form of an ointment. The following is one in much use:

℞—Methyl salicylatis,
Menthol .... āā 15 per cent.
Petrolati ....q.s. ad 1 oz. (30 Gm)

An ointment containing ichthyol has been much praised. For example:

℞—Ichthyol .... 25 per cent.
Petrolati ....q.s. ad 1 oz. (30 Gm)
M. et S.—Local use.

Counterirritation. Counterirritation is a very old remedial measure, which has survived the rise and fall of countless therapeutic efforts, and the very persistency of which, in this Nihilistic age, speaks for its reality. It is indicated rather in the subacute stages of joint inflammation than in the acute. Of the many means of inducing it, I will mention two only as worthy consideration—the **cautery** and the **fly blister.** Of the two, the former is much the better, as being easier of application, easier of control, less likely to be followed by bad results locally, and entailing no danger from absorption. The cautery is flicked lightly over the part, care being taken to avoid severe blistering or deep burns. The part is then smeared with vaseline, oil, or ointment.

In applying the blister **(ceratum cantharadis)**, it is cut about one inch square. In making the application to the knee, four such might be used, one above and one below on either side. Shave and cleanse the part. Oil the edges of the blister and apply a little vaseline to the skin adjacent to the blister, to avoid its spreading. Leave the blister in position for four to six hours, and if a blister has not formed in the skin by this time apply a warm poultice to the part, which will hasten its formation. Puncture the blister on its dependent edge, evacuating the serum but not destroying the protecting epithelium. Dress with oil. Some of the disadvantages of the blister have just been set forth, and in the presence of a damaged kidney, as may occur in the course of rheumatism, the dangerous irritating effect of this drug on the parenchyma of the kidney, which it causes in the course of its excretion, must be kept in mind.

Pressure. When an effusion is slow to absorb, one may hasten the result at times by applying a snug bandage of flannel or rubber, which will exert a continuous but moderate pressure.

In persistent effusions, and effusions will sometimes persist, after both temperature and pain have ceased, and in the acute stage with excessive and painful effusion a **paracentesis** is indicated. Often the effusion will not recur in the subacute cases, while the relief to the patient in the acute cases is highly gratifying. The procedure, simple as it is, should be hedged about by all the precautions of a major operation, for an infection of the joint by a pyogenic organism is a serious matter.

If paracentesis be done and the opportunity affords, cultures of the aspirated fluid should be made for the identification of the organism and its use as a vaccine. Personally, I have been very rarely rewarded by culture of the joint fluid in the acute cases.

Later Measures. Chronic rheumatism is spoken of by both the layman and the physician as of common occurrence. In truth, chronic rheumatism as a sequence of true acute rheumatism is a rarity. Some men believe it never occurs and for a time I was of this opinion; but recent studies in my wards have convinced me that it is an occasional happening. If it does occur care must be exercised to prevent ankylosis. Splints must be occasionally removed and plasters and bandages taken off. Gentle manipulation of the joint must be carried out; or intelligent massage, hot fomentations, hot air baths, and baking had recourse to to facilitate absorption and resolution. In these later stages it is still believed that the iodide of potassium may do good.

Better in my estimation is the use of vaccines (see below).

COMPLICATIONS

Hyperpyrexia. The sudden onset of excessively high temperature, with extreme restlessness, headache, vomiting, delirium, and later coma, suggestive of meningitis, while occurring in the course of other febrile processes, is relatively common in rheumatism. It must be treated promptly and on the same principle as a sunstroke, that is, by a **rapid withdrawal of heat.** This is effectually done only by the use of cold baths or packs. The patient is put into a tub at 65° F., or, if the shock is too great, the water may be warmed to 80° F., and as the water warms from the patient's body heat, the temperature is kept down by adding ice to it. The patient should be kept in the bath until the temperature falls several degrees. If a fall to about 102° F. can be attained, the patient should be removed from the bath, as the temperature will often continue to fall. During the bath, ice or cold water should be applied to the head. The bath should be repeated as often as the temperature rises to between 104° F. and 105° F. If the patient becomes chilled, is cyanosed, the temperature falls well below normal, or collapse threatens, he should be removed from the bath, put in warm blankets, heat applied, and stimulants freely used. **A cold pack,** the wet sheet in which the patient is wrapped being continuously rubbed with pieces of ice until the desired drop is obtained, is sometimes quite as efficacious as the bath.

Cardiac Complications. The frequency of these complications, and their gravity, threatening not merely the patient's life in the present attack, but, worse yet, his future, dooming him to a life of invalidism and dependence, make them by far the most important features of the attack, and haunt the physician from the incipiency of the disease. A visit should never be completed without a careful examination of the heart. Changes in rate, rhythm, quality of sounds, or the appearance of adventitious sounds, should immediately put the physician on his guard. It cannot be too emphatically insisted that the mildest attack, as judged by fever, pain, joint implications, and general discomfort, may still be accompanied by grievous heart **complications.**

Statistics vary, but from reliable sources it is gathered that pericarditis occurs in 15 per cent. of the cases, and endocarditis in over 50 per cent.; in children under ten years, in as high as 75 to 80 per cent.

Lees insists that in every case of rheumatism dilatation of the left ventricle can be made out. It is, he says "an inevitable manifestation of the disease and one of its earliest symptoms" (*British Med. Journ.,* October 12, 1912), and, certainly, the more one gives attention to alteration of cardiac sounds and outline the more convinced he is of the very high per cent. of cardiac involvement.

It must be remembered that a more proper term for what actually exists in the heart is pancarditis, for the whole structure is likely to be implicated. The treatment of these conditions is the same as when occurring under other circumstances, and I will merely add that when there are signs of cardiac decompensation I am a firm believer in the use of the digitalis series in the acute cardiac disease in the same large doses as in the chronic form. The only question to be discussed at this juncture is the use of salicylates. Some authors fear the depressing effects of the drug. Others still consider that the appearance of the cardiac complications indicates no change in the treatment. Personally, I have always continued the salicylates; and in the same liberal doses as in uncomplicated cases.

I have never been convinced of any bad results by so doing unless the rare occurrence of the bradycardia mentioned be called such. If salicylates have any effect on the disease organisms themselves, it would seem as if their use in the serious complications of the disease was the more urgent.

Any case of rheumatism in whom a cardiac complication is evident should be kept in bed two months, even though joint manifestations and temperature promptly disappear, and as much longer as the cardiac condition and symptoms of the infection continue.

While cardiac murmurs have great significance, they need not necessarily be present when the heart is affected; hence, the great importance of familiarity with the first and second sounds of the heart and their variation when the myocardium is involved and an appreciation of changes in cardiac outline.

While the presence of murmurs should indicate heart involvement (with the exception perhaps of certain murmurs in the 2nd left intercostal space) they need not necessarily mean endocarditis or valvular change; for a goodly per cent. of them disappear and are probably attributable to hyperæmia of the valves or such an affection of the myocardium as entails a relative insufficiency of the valves. The statistics of some authors (Kemp) show that nearly half of the cases with cardiac complications clear up their signs before leaving the hospital and that no mean proportion of these not cleared up at the time of discharge have no permanent damage to the valves.

Aortic valve lesions show more myocardial involvement than the mitral (Brooks).

Double valve lesions and pericarditis increase the gravity, but the repetitions of the cardiac involvement is what constitutes the greatest danger.

When all active manifestations of the rheumatism have ceased and the patient has been kept in bed six weeks to two months beyond this, he may be allowed up in a chair and then on his feet, but always guided by the cardiac response; for a pulse rate out of all proportion to the effort made betokens a cardiac irritability that gives warning of the prematurity of the effort.

In case the heart decompensates, it is to be treated as a decompensated heart under other circumstances.

Pulmonary Complications. Pneumonia and pleurisy occur in a considerable number of cases, some authors giving the figures as high as 10 per cent. I, myself, have seen it frequently in the severe rheumatism, and always with cardiac involvement.

The treatment is such as would be instituted under other circumstances, and does not call for an intermission of the salicylates.

Other Complications. **Sore throat,** if severe is to be treated as described under Scarlet Fever (see Chap. IX).

The **mouth** throughout the illness should be kept scrupulously clean (see Pneumonia, Chap. IV).

The assurance of **sleep** is an essential part of that cardinal principle of treatment, rest. **Trional** in doses of grains x–xx (0.6–1.3 Gm) or chloralamid in doses of grains xx–xl (1.3–2.60 Gm) may be used for milder cases of insomnia, but when pain is responsible for wakefulness **morphine** in the smallest dose efficient shuold be used.

Other complications are numerous but rare.

The skin eruptions urticaria, erythema multiforme or nodosum, and purpuras require no special treatment.

Hemorrhages from the nose, stomach, bowel, kidney may occur but rarely demand interference.

Venous thrombosis is a rare complication and is treated as under other circumstances. Once in my experience a thrombosis of the popliteal artery occurred necessitating amputation.

Anæmia is a striking feature of the disease, and indicates in convalescence the use of iron and iron-containing foods.

Sweats of a severe type have long been associated in the minds of physicians with rheumatism, and may require especial consideration. They are very acid, and may cause considerable irritation. Sponging with a mild alkaline solution, as 1 per cent. sodium bicarbonate, gives relief. The skin should be kept dry with one of the numerous powders that contain talcum, or one made of equal parts of zinc oxide and starch. If the sweating is very severe, atropine may be used in doses of 1/100 to 1/50 grain. (0.0006–0.001 Gm.)

VACCINE THERAPY. I am among those who believe rheumatism is due to an infection. Whether to one organism and one only, I am not prepared to say; but I have been able to isolate an organism from the blood of several of my cases which has the morphological and cultural characteristics of streptococcus viridans; whether biologically identical with the organism of Schotmüller or no I do not know.

When the facilities permit, all cases of acute rheumatism should be subjected to blood culture. Cultures should also be taken from the deep crypts of the tonsils, from an excised subcutaneous nodule, from joint fluid, from obvious foci of infection, teeth, sinuses, ears and in colitis cases, the mucous discharge, and in bronchitis the mucous discharges.

I have recovered the organism from the blood, tonsils, teeth and nodules, but have not been as successful as some workers in securing them from the joint fluids.

Any organism recovered should be used as antigen in a complement fixation test for corroboration, and in the absence of an organism one may use the patient's blood against various strains recovered from other cases as antigens, using the organism that fixes strongly as the probable causative organism.

Fixation tests are only rarely feasible and must be done most carefully. If not feasible it need not deter the usage of organisms recovered from the sources named, if due precautions are used to exclude contaminations. Such cultures are used for the production of vaccines. The patient, then, will get an autogenous vaccine, except in those cases in which we depend on the fixation of foreign strains.

The best time for the use of vaccines, is in the subacute stages, or between the exacerbations of rheumatism.

The Dosage. The first dose should be tentative. I begin with 5,000,000–10,000,000, though some authors prefer so low a dose as 1,000,000. It is my custom to give the dose twice a week. The increase in dose depends upon the reaction. If there is no reaction one may double the dose to 10,000,000, 20,000,000, 40,000,000, 75,000,000, 125,000,000, 200,000,000, and then 100,000,000, or more, added to each dose.

If there is a slight local reaction one advances more cautiously; if a slight general reaction, do not increase the next dose, if a marked general reaction, wait for two or three days after it has subsided and begin again with a lesser dose.

I have myself provoked an unfortunate exacerbation of symptoms with too large a beginning dose (in this case 50,000,000), and know of the occurrence of anaphylactic shock after the ignorant usage of colossal initial dosage.

The reaction may be a reddened and tender area at the site of injection or a recrudescence of local lesions, e.g., in joints or a general reaction of fever, accelerated pulse and the other toxic manifestations of slight infection. More serious consequences can follow careless dosing.

The number of injections is a matter of judgment and depends on results. I prefer eight to twelve doses and sometimes more.

The technique is that of any hypodermic injection, a clean syringe and needle and a clean site of injection.

The syringe should be graduated like a tuberculin syringe to hundredths of a c.c.

When the heart is involved one should be even more careful in the dosage.

CHOREA

Chorea is often looked upon and treated as a separate and distinct disease, but chorea minor or Sydenham's chorea, long appreciated as mysteriously connected with rheumatism and as commonly complicated by the same kind of cardiac disease as acute rheumatism is now pretty generally looked upon as but one manifestation of rheumatism. Like Poynton and Payne, we have isolated an organism from chorea identical with that we have isolated from rheumatism, although in ours we can see only the cultural characteristics of the streptococcus viridans.

Treatment then of chorea minor is the treatment of rheumatism except that rest is even more insisted on and more difficult to attain when both fever and pain are absent.

Isolation is a very important part of the treatment. This is a guarantee of freedom from excitement. All visitors and relations are excluded and the child sees only the mother or nurse. How absolute this shall be, how long continued depends on the progress of the case and the temperament of the patient.

As avoidance of excitement as well as physical rest is the desideratum, much depends on the temperament of the mother or nurse. This does not mean that the patient is imprisoned and such isolation can be carried on in the open air or the patient sent away to the country with the nurse and isolation effected there. In acute cases, however, the darkened quiet room is preferable.

The **diet** should be sufficient and that of the healthy child in the milder cases and in the acuter cases sufficient too, but chosen as in the febrile cases.

These measures alone are often sufficient. They should be persisted in until effectual or for six weeks to two months have passed. Of course a time comes when the need of light and air makes us abandon the closer confinement or the child's depression may forbid its continuance.

Local Measures. **Warm baths,** especially before sleeping are often sedative in their effects and sometimes **hot packs** have a similar result.

In febrile cases **cool sponges** may be of value.

Drugs. As a rheumatic manifestation **salicylates** are indicated as in acute rheumatism, but there is quite a widespread belief that of the salicylates **aspirin** has a decided superiority over the others. The dosage should be that specified for rheumatism.

Time honored, too, is the use of **arsenic.** It may be given in any form, but the preparation perhaps to be preferred is the Liquor potassii arsenitis or Fowler's solution. The dose begins with m. ij to iij (0.20 c.c.) increasing up to the point of tolerance.

The urine is carefully watched meanwhile and with any evidence of albuminuria the drug is promptly stopped. If the stomach or bowels are affected or there is puffiness under the eyes we stop until the symptoms disappear and begin again on half the dose.

Vaccines. I have had but a limited experience with the use of vaccines in chorea, but believe there is a field for them in chorea, when administered with the above precautions.

I deplore the use of mixtures of organisms of unknown value and strength so widely advertised by commercial interests.

When the patient is very restless and the movements severe, one may use **choral,** best by rectum, in doses of grains v–xxx (0.30–2 Gm) according to age. Remembering that children bear relatively large doses.

For the worst forms and the maniacal type **morphine** in doses of gr. 1/16–1/4 (0.004–0.016 Gm) or **hyoscine** hydrobromide gr. 1/200–gr. 1/100 (0.0003–0.0006 Gm) may be necessary.

Convalescence from Rheumatism. The patient should be kept in bed for some time after the symptoms have subsided, one or two weeks; if the heart has been involved, longer, as detailed above.

The diet should be increased to include green vegetables, later eggs, fish, and meat if they have not already been allowed. It should be simple in its character and in the manner of its preparation. It should be sufficient, but not excessive, nor should the patient be teased to stuff by palatable dishes. A change of environment often helps to establish convalescence, but the patient should not be hurried away too soon or exposed to discomforts in his new surroundings for the mere sake of the change.

Prophylaxis. The avoidance of rheumatism, so lamentable in its consequences, must rest upon our education of the public in hygiene, through the schools and other agencies. The gospel of fresh air must be preached, clean bodies, proper clothing, avoidance of neglect, such as remaining in wet and damp clothing. More than this, parents and teachers must be made to understand the meaning of chorea, sore throats, stiff necks, and "growing pains" in children, and the results of neglect.

The physician should be the teacher, as the term "doctor" implies both in his daily walks and in the more public capacity of lecturer, health officer, school inspector, etc. The school inspectorship is rife with the possibilities of infinite good.

The upper air passages afford the portal of entry of the vast majority of rheumatic infections.

Tonsils and adenoids hypertrophied to the point of obstruction, even though they have never been the seat of acute infection should be removed.

Tonsils and adenoids that have been the seat of infection whether accompanied or followed by rheumatism or not should be removed.

Tonsils and adenoids in all cases of rheumatism should be removed between the attacks.

I favor complete enucleation of the tonsil. The tissue should be carefully preserved in a sterile container to be submitted to bacteriological investigation for the purpose of identification and preparation of vaccines.

Sinuses should be examined and any abnormality of the nose attended to.

The teeth, especially that condition known as pyorrhea alveolaris contribute to infection, though in my experience the deforming forms of arthritis have more commonly been associated with this infection than the clinically true rheumatism.

These should have dental consideration and it is a condition that puts to the test the best dental skill.

Some investigators believe that bronchial infection and intestinal infection point the road to rheumatic infection and certainly these conditions demand attention.

Rheumatic children, especially, when showing nervousness should not be urged at school.

Moon has sensibly remarked that they should do no evening work and should rest in the middle of the day.

When in these cases headache and poor sleep intervene or there is a frank exacerbation of nervousness the little patient should be taken out of school until matters improve.

Damp cold has long been known to provoke rheumatism and recurrences of rheumatism and Rosenow declares that exposure to cold after injection of rabbits with the rheumatic organism increases the percentage and degree of joint involvement.

This of course accentuates the necessity of avoidance of exposure to cold and wet; the importance of promptly changing wet stockings and clothes, removal from cold damp houses and localities and the importance of warm clothing, and especially underclothing containing wool.

SUMMARY

Rest.

Quiet.
Exclusion of visitors.
Mental rest.
Freedom from annoyance, conversation, business cares in the adult, efforts at amusement in children.
Good nursing.

Bed.

Hospital type preferred.
Woven wire spring.
Firm mattress.
Flannel blankets.
Flannel nightgown—open down front or side.

Room.

Light and air.
Avoid draughts.

Temperature 65° F. to 70° F.
Open air.

Diet.

Calories—approximate 3,000 in adult and more if well taken.
Proteid 65 to 75 grams.
During early hours with high fever and anorexia don't push food.
Milk—640 calories to 1 quart.
Sugar—120 calories to 1 ounce.
Cream—50 calories to 1 ounce.
Cereals—about 100 calories to large serving.
Rice—about 100 calories to large serving.
Bread—100 calories to thick slice (1 & ⅓ ounce).
Butter—100 calories to pat (scant ½ ounce).
Eggs—70 calories to each.
Milk, soups, mutton broths, chicken broths thickened with rice or cereals.
$\left.\begin{array}{l}\text{Vegetables}\\ \text{Fish}\end{array}\right\}$ as temperature approaches normal.
Meats after temperature has been normal a few days.

Bowels.

Salts—Epsom, Rochelle—Glauber's ʒss-j (15–30 Gm) followed by enema of plain water or soapsuds if needed.
Constipation to be avoided especially while giving salicylates as it increases liability to acidosis.
LATER.
Enemata.
Salines.
Hunyadi water—other mild equivalents on the market, Liquor magnesii citratis, ℥ viii–xii (240–360 c.c.), Seidlitz powders or, if obstinate, salts mentioned above and enemata to follow.

"Specific" Treatment.

Sodium salicylate gr. xx (1.3 Gm) every two hours. As pain subsides cut gradually to gr. xv, then gr. x (1.00–0.60 Gm) every two hours.
Keep at gr. x (0.60 Gm) until all active phases have past.
After symptoms have disappeared gr. x or v (0.60–0.30 Gm) every two or three hours for a week or ten days.
Then for four to six weeks give gr. x or v (0.60 or 0.30 Gm) three or four times a day. Continue with alkali (see below).
If satisfactory results do not ensue increase dose to production of toxic manifestations.
This may be anticipated in the adult in the neighborhood of 150 to 200 grains a day, depending on the sex (weight).
Administer alkali; citrate of potash, acetate of potash, bicarbonate of soda, enough to render urine alkaline and keep it alkaline or neutral.
Rule—two grains of the alkali, preferably bicarbonate, for one of the salicylate.

Toxic manifestations—see text.

℞

Sodii salicylatis	15.00	℥ss
Aquæ distillatæ q. s. ad.	60.00	℥ii

M. et S. ʒi (4 c.c.) in water every two hours.

or

℞

Sodii salicylatis	15.00	
Glycerini	15.00	āā ℥ss
Aquæ distillatæ q. s. ad.	60.00	℥ii

M. et S. ʒi (4 c.c.) in water every two hours.

or

℞

Acidi salicylici	15.00	℥ss
Sodii bicarbonatis	q.s.	q.s.
Aquæ distillatæ q. s. ad.	60.00	℥ii

M. et S. ʒi (4 c.c.) in water every two hours.

Aspirin, acetyl-salicylic acid, gr. xv–xx (1.00–1.30 Gm) every two hours.

℞

Aspirin	10.00	ʒiiss.

Divide in capsulas No. xxx.
S. 3 or 4 every two hours.

Give alkaline as above, but between the doses to avoid incompatibility, or push dose to toxic manifestations.

This may be anticipated in the adult near 120 or 160 grains a day depending on sex (weight).

Toxic manifestations (see text).

Methyl salicylate and oil of gaultheria in m. xv–xx (1.00–1.30 c.c.) every two hours.

℞

Olei gaultheriæ	20.00	ʒv

Divide in capsulas No. xxx.
S. Two every two hours.

or

℞

Olei gaultheriæ	15.00	℥ss
Acaciæ	q.s.	q.s.
Aquæ distillatæ q. s. ad.	60.00	℥ij

M. et fiat emulsum.
S. ʒi (4 c.c.) in water every two hours.

or

℞

Olei gaultheriæ	15.00	℥ss
Potassii citratis	30.00	℥i
Acaciæ	q.s.	q.s.
Aquæ distillatæ q. s. ad.	120.00	℥iv

M. et fiat emulsum.
S. ʒij every two hours.

Give bicarbonate or other alkali gr. ii to m. i of the oil or push to production of toxic manifestations.
These may be looked for at about 120 minims (8 c.c.) a day.
For toxic manifestations (see text).
Diplosal—(salicylo-salicylic acid) gr. x (0.60 Gm) every two hours.

℞
Diplosal .... 20.00 ʒv
Divide in capsules No. xxx.
S. One every two hours.

Or push to toxic manifestations, which may be anticipated as dose approximates 80 to 100 grains a day depending on sex (weight).
Administer alkali between doses. Dose about gr. iv (0.25 Gm) per grain diplosal.
Toxic manifestations (see text).

Acidosis—see text.
Avoidance by giving alkalis (as above).
Avoidance of constipation.

Rectal administration of salicylates.
Use a thin starch paste at body temperature, ℥iv–vj (120–180 c.c.).
Add ½ daily dose of salicylate, e.g., ʒi (4 Gm).
Add m. i to ii of tincture of opium if needed to retain.
Inject slowly; hold buttocks together for a few minutes.
Dose every twelve hours.
or
Give whole dose, e.g., ʒii (8.00 Gm) in the same amount of starch paste once a day.
Alkalis, e.g., bicarbonate of soda, is given at two hour intervals by the mouth, the total day's dose to amount to two grains to one of the salicylates.

Intravenous administration.
Technique—see text.
Use when salicylates can not be borne for any reason as in the case of idiosyncrasies.

Drugs to relieve pain.
Acetanilid, gr. iss (0.10 Gm) every ½ hour for 4 doses; repeat at six or eight hour intervals, or gr. ii–iii (0.15–0.20 Gm) every two hours.
Give in capsules or powders.
Phenacetin, gr. iii to v (0.20–0.30 Gm) every two hours. Give in capsules or powders.
Antipyrin—gr. iii–iv (0.20) every two hours.
Give in capsules or solution.
For severe pain.
Morphine best hypodermically, gr. 1/16–gr. ⅛ (0.004–0.008) adult dose.

Symptomatic Treatment.

- Joints.
- Rest.
- Semi-flexion.
- Pillows, cushions, sand bags.
- Carefully padded splints.
- Cold.
- Ice bag or ice coil.
- Cold compresses.
- Fomentations.
- Protection with non-absorbent cotton and flannel bandages.
- Drugs.
- Methylated salicylate or oil of wintergreen.

℞

Methyl salicylatis.
Menthol ....āā 15 per cent.
Petrolati q. s. ad ....30.00 ℥i.
M. et fiat unguentum.
S. Local use.
Ichthyol.

℞

Ichthyol ....25 per cent.
Petrolati q. s. ad ....30.00, ℥i
M. et fiat unguentum.
S. Local use.

Counterirritation.

- Cautery.
- Fly-blister.
- Pressure.
- Flannel bandage.
- Rubber bandage.

Persistent effusions.

- Paracentesis.
- LATER MEASURES.
  - Gentle manipulation.
  - Massage.
  - Fomentations.
  - Baking.
  - Vaccines.

Complications.

- Hyperpyrexia.
  - Cold baths.
    - Put in tub at 65° F., or to save shock at 80° F., cooling it to 65° F., gradually.
    - Keep temperature of water down by adding ice.
    - Take patient out when temperature is 102° F.

Repeat when patient's temperature rises to 104° F. or 105° F.

Cold packs.

Sheet wrung out of cold water and wrapped about patient's body and then rubbed with pieces of ice.

Cardiac Complications.

Continue salicylates in full dose as described above.

Continue in bed two months at least, after all other signs of rheumatism have disappeared, and as much longer as the condition of the heart may seem to warrant.

Allow first to sit up, then to get on feet, but always guided by evidences of heart's stability.

Increased rate and tumultuousness of beat out of proportion to effort made, indicates continuance of rest.

If heart decompensates it is to be treated like a decompensated heart under other circumstances.

The acute febrile process does not contra-indicate the use of digitalis in full doses.

Digitalis, full dose the equivalent of gr. ix–xii (0.60–0.80 Gm) daily for three or four days or until signs of accumulation or desired results ensue, then stop two or three days and resume with smaller dose gr. iii (0.20 Gm) a day (adult dose).

Pneumonia and pleurisy.

Treat as under other circumstances.

Continue salicylates in full doses.

Sore throat.

Careful oral toilet (see Pneumonia, Chap. IV). When severe treat as in Scarlet Fever (see Chap. IX).

Insomnia.

Trional, gr. x–xx (0.60–1.30 Gm) in early evening and repeat if needed two or three hours later (adult dose).

Give in capsule or powder.

Chloralamid, gr. xx–xxx (1.30–2. Gm) in early evening; repeat, if needed, in two to three hours (adult dose).

When pain is present use morphine hypodermically gr. $\frac{1}{16}$–gr. $\frac{1}{4}$ (0.004–0.015 Gm) (adult dose).

Anæmia.

Iron. Blaud's pill (Pil. ferri carbonatis), or Vallet's Mass (Massa ferri carbonatis) gr. v–x (0.30–0.60 Gm) three times a day.

In children lesser doses of same, or bitter wine of iron (Vinum ferri armarum) ʒi–iii (4–12 c.c.), three times a day.

Sweats.

Sponging with 1 per cent. bicarbonate of soda.

Talcum powder.

Zinc oxide and starch equal parts. Apply locally.

Atropine, gr. $\frac{1}{100}$ to gr. $\frac{1}{50}$ (0.0006–0.0013 Gm).

Vaccine Therapy.

Use only autogenous vaccines, or, lacking these, only strains shown by complement fixation to have been or to be an infecting organism.

Seek organisms by cultures.

1. from blood.
2. from joint fluid.
3. from subcutaneous nodules.
4. from depths of tonsillar crypts.
5. from sites of obvious infection as teeth, ears, sinuses.

Prove, especially, 4 and 5 by complement fixation.

Time to use vaccines.

During subacute stage or between exacerbations.

Dosage.

1st dose tentative, 5,000,000–10,000,000.

In cardiac case 1,000,000–5,000,000.

Frequency.

Twice a week.

Succeeding doses.

In the absence of reactions, double the doses up to 150,000,000–200,000,000 then increase by 100,000,000 at a dose.

Reaction. (See text.)

If reaction is slight and local do not increase next dose.

If reaction is severe and general wait until all signs of reaction have subsided for two or three days and begin with lesser dose.

Number of doses.

Depends on results and is a matter of judgment, 10 to 12 or perhaps more.

Technique—that of any hypodermic medication; cleanliness of instruments, operator and site of operation.

Syringe graduated to fractions of a c.c., e.g., tuberculin syringe.

In cardiac cases.

Beginning dosage lower.

Advance in dosage more cautiously.

Chorea.

Rest in bed.

Isolation.

Diet. Liberal if afebrile; as in rheumatism if febrile (see above).

Local measures.

Warm baths especially before sleeping, or two or three times a day. Hot packs once a day. Cool sponges in febrile cases.

Drugs.

Salicylates in full doses as in rheumatism.

Aspirin the form preferred.

Arsenic; any form.

Fowler's Solution (Liq. potassium arsenitis), m. ii–iii (0.20 c.c.) as a beginning dose, increase a minim a day or a minim a dose a day up to the point of tolerance; that is, disturbance of stomach or bowels or puffiness under the eyes.

Watch urine for albumin.

- Then stop until symptoms disappear; begin with ½ largest dose and increase again.

Vaccines.

- As in rheumatism, but with less dose and cautious increase.
- Marked restlessness and violent movements.
  - Chloral, gr. v–gr. xxx (0.30–2.00 Gm) in ℥ii–iii (60–90 c.c.) of warm milk by rectum at night. (Children take large doses relative to their age.)
- Most severe and maniacal cases.
- Morphine sulphate, gr. 1/16–gr. ¼ (0.004–0.015).
- Hyoscine hydrobromide, gr. 1/200–gr. 1/100 (0.0003–0.0006 Gm).

Convalescence in rheumatism.

- In bed one or two weeks after symptoms subside.
- In cardiac cases longer, as above.
- Diet. Made more liberal. Change of environment to be considered.

Prophylaxis.

- Education of public.
- Fresh air.
- Cleanliness.
- Warm clothing.
- Avoidance of chilling.
- Inspection of upper air passages.
- Elimination of tonsils and adenoids.
- Teeth to be attended to.
- Avoidance of excitement and urging in school of the nervous children already infected.

CHAPTER IV

PNEUMONIA

The term **Pneumonia** as commonly used means an acute infection of the lung. Such an infection may be primary or may be secondary to another infection. From the pathological standpoint two great groups of pneumonias are recognized: **Lobar Pneumonia** and **Broncho-pneumonia.**

Lobar pneumonia is a form of pneumonia commonly met with in adult life and forms a considerable percentage of the pneumonias of childhood.

Broncho-pneumonia is particularly common in infancy, early childhood and in old age. It is, too, the common form of secondary pneumonia.

Lobar pneumonia is characterized pathologically, by an intra-alveolar exudate containing a great deal of fibrin and no interstitial infiltration.

Broncho-pneumonia is characterized by a lesser intra-alveolar exudate with far less fibrin and much interstitial infiltration of the bronchial tissue and alveoli.

Pleurisy is common in lobar pneumonia; not as common in broncho-pneumonia.

Etiologically, lobar pneumonia is due to a group of organisms, having, morphologically and culturally, features in common, but biologically divided into a number of groups each inducing a specific reaction on the part of the tissues. These are called in general pneumococci and include the streptococcus mucosus capsulatus or as it is sometimes called, pneumococcus mucosus capsulatus.

Broncho-pneumonia is caused by a variety of organisms, including the pneumococcus, various types of streptococci, as well as other organisms, such as the micrococcus catarrhalis, the influenza bacillus, colon bacillus and other rarer types.

THERAPY

The general principles of therapy applicable to the one form are also applicable to the other. Certain details of one or the other form of pneumonia may demand modifications or differences in treatment. These will be considered.

Rest. First of these in importance is rest. Rest means rest in bed in a quiet environment. When the patient is very sick it means avoidance of every muscular effort even turning in bed being done by the nurse or attendant; use of the bed-pan and urinal; absolute interdiction of the effort to arise to attend to these matters. It means competent nursing; it means freedom from worry, anxiety, introduction of business cares and concerns; it means the exclusion of all visitors and of all individuals who are not concerned in the care and comfort of the patient.

Bed. Rest in bed is rest only when the bed is comfortable. The type of bed is best illustrated by the hospital bed. It is a half or at most three quarters bed with a firm woven wire spring, and a firm but resilient mattress. The bed-clothes must be applied smoothly and without wrinkles; the clothes upon the patient chosen to avoid excess of weight and should be no more than afford maximum comfort to the patient; only one pillow should be used. For purposes of cleanliness as well as comfort a rubber sheet should be placed across the bed. The width of this sheet should be such as to reach from the pillow to the bend of the patient's knees and sufficiently long to tuck under the mattress nicely. Over this sheet should be placed a draw-sheet, a long sheet folded lengthwise with width enough to cover the rubber sheet and so long that it may be drawn from the one side to the other from time to time to bring a cool surface to the patient's body or to remove a soiled spot.

Room. The room should be chosen with reference to sufficiency of light and air.

It should be stripped of all unnecessary furniture; if possible, it should be so near the bathroom as to facilitate the many demands of nursing.

Even better is a room from which a verandah or porch may be approached, on which the patient may be wheeled, if necessary.

Temperature of the Room. This should be about 65° F. unless the patient is submitted to cold air treatment.

Care of the Body. The care of the body is of prime importance as it means comfort to the patient and a more efficient performance of important functions. This is the particular province of the nurse, but when a nurse can not be in attendance it is the business of the physician to explain the details to whomsoever is to act as nurse, of all that constitutes the proper care of the body.

Bath. A sponge bath should be given for purposes of cleanliness, as well as comfort every day. The only excuse for omission of the bath is such a weakened condition on the part of the patient that even the little manipulation concerned in it becomes to him a source of exhaustion and danger.

The temperature of the room when the bath is given should be from 65° F. to 70° F. If this can not be effected the bath may be given between blankets. Tepid water and castile soap are used and the skin gently wiped or dabbed dry with a towel.

Special attention should be given to the eyes, the ears, the parts of the body most pressed upon and likely to become the seat of bedsores; the genitals and the anus.

Mouth. The care of the mouth is of great importance, especially in early toxic cases, when the patient is stuporous or comatose, the mouth dry, the tongue coated, the lips and teeth covered with sordes and in these cases secondary infection affecting the parotid gland and the middle ear and possibly complicating bronchi and lungs with secondary invasion, as well as imperilling the digestive tract, are to be constantly kept in mind.

In all cases the mouth should be rinsed after each feeding with some mild antiseptic solution, such as a saturated solution of boric acid, 4 per cent. or half-saturated solution, 2 per cent. or one may use Dobell's solution, ½ or ¼ strength.

The **teeth,** too, should receive attention. The interstices freed from particles of food that may undergo decomposition. The best way to do this is to use closely rolled swabs of absorbent cotton on wooden tooth-picks; these being wet with the solutions named. A soft tooth brush may be used, but care has to be exercised to avoid trauma of the gums or lips.

Tongue. When the tongue is much coated and when there is sordes upon the teeth or lips, half-strength peroxide of hydrogen should be applied to soften the deposit and the excess scraped away with the edge of a whalebone or similar instrument and then the tongue and lips should be cleansed with the above solution. For a very dry mouth a mixture of equal parts of albolene and 2 per cent. boric acid solution flavored with lemon juice is an excellent application. When the breath is fetid or there is much stomatitis an application of an antiseptic solution as follows is excellent:

Carbolic acid (phenol), watery solution 1–20
Glycerine .... āā ℥ j (30 c.c.)
Boric acid, saturated watery solution .... ℥ viij (240 c.c.)
M.

Collections of mucus in the naso-pharynx and the back of the mouth are best removed with cotton swabs on long applicators, which have been saturated with some of the mild antiseptic solutions.

Gargles do not reach back to the naso-pharynx and rarely reach the tonsil. The back of the mouth, then, should be cleansed by the use of a spray, the tongue being depressed with an applicator, while the spray is used. A boric acid solution or a Dobell's solution may be used for this purpose.

Nose. Attention also, should be given to the nose; for if this is plugged with secretions, the patient is obliged to breathe through the mouth and the dryness of the mouth and coated tongue is aggravated. Dried secretions should be softened by the application of vaseline or sweet oil and then the nose is cleansed with a cotton swab on a toothpick or other applicator, which has been saturated in one of the solutions mentioned.

Sprays, too, may be used. Irrigations should be avoided, lest, especially if the patient is somewhat stuporous, the solutions are forced into the Eustachian tube, carrying with them infection.

Fissures and **herpetic eruptions** should be treated with the solutions and then anointed with the oil or vaseline.

Eyes are to be kept clean by the use of half strength or saturated boric acid solution.

Care of the **genitals** require a careful cleansing after every defecation and in the female after micturition. The same solutions may be used for this purpose. If there are excoriations a carbolic acid solution ½ per cent. to 1 per cent. may be used, then the parts are to be kept dry and dusting powder applied to the skin about the parts.

Diet. The dietetic demands are quite different in the acute lobar pneumonias, of short course, marked by much intoxication, and the longer continued broncho-pneumonias or the unresolved pneumonias or pneumonias with complications that prolong the course, for a considerable period of time.

The impairment of digestion and assimilation is much less than is usually assumed. Such impairment as there is lasts only during the early hours, the first day or two, of an acute process or when the intoxication is very intense. During this time there is often gastric distress and usually anorexia. It is better at this time not to force the food, but after this period has passed certain theoretical considerations have to be kept in mind. These are that a man at rest, suffering from an infectious process expends as much energy as a well man at rest, but in addition to this the febrile process, when the temperature is above 102° F. or 102.5° F., increases the need of food intake some 25 per cent.

These two requirements amount to about forty calories per kilo of body weight or some 2,800 to 3,000 calories for the adult male of average weight; but in addition to this the acute infection induces a proteid loss that can be prevented only by increasing the food intake even above the amounts already mentioned. No amount of proteid intake will make good for this proteid loss unless a sufficiency of carbohydrate should be administered with the proteid. Under these circumstances proteid intake of from seventy to ninety grams are sufficient.

We rely particularly upon **milk.** One quart of milk gives about 640 calories or about twenty calories to the ounce. It is obvious, however, that if we were to use milk alone the quantity necessary to supply the number of calories required would be inordinate. It becomes necessary, then, to add other articles of food, which have a high calorie content and a low proteid content. One of the simplest means of obtaining such a result is to add cream.

Gravity cream, 16 per cent. cream, affords about fifty calories to the ounce. Milk sugar is another substance that can be added to the milk, each ounce giving 120 calories.

A half ounce of milk sugar and one ounce of gravity cream added to each glass of milk increase the calorie content a little over one hundred. Other substances that may be added are cereals, such as thoroughly cooked oatmeal, or hominy or rice; an ordinary serving of these articles of food, varying from three to five ounces, according to the nature of the cereal adds another one hundred calories. When cream and sugar are added to such a serving, the calorie content is greatly increased; as two ounces of cream and three teaspoonfuls of granulated sugar offer each an additional one hundred calories.

One may give eggs, raw or soft cooked. A coddled egg, that is, an egg which is put into boiling water and then set aside from the stove and allowed to cook as the water cools for five minutes thus acquiring a creamy consistency makes an excellent addition to the dietary; eggs and milk in the shape of cup custard, broths made of cereals and milk; bread given as toast or as milk toast or plain bread and butter, all add materially.

Various milk preparations may be used in place of milk, such as matzoon, koumys, zoolak, buttermilk.

If the patient's appetite craves them, meat soups, mutton broth or chicken broth may be given and rice or other cereal-flour may be cooked into them to give them some caloric value.

If tympanites occurs one suspects the milk sugar as being responsible. If diarrhea ensues one cuts down upon the fat; while both fat and sugar may be responsible for gastric distress and vomiting. Under these circumstances these elements must be cut out until the symptoms disappear and then gradually replaced.

In a lobar pneumonia of short course, then, we give an abundance of water in the early days, with small amounts of milk. If the stomach be irritable, this milk had better be diluted either with plain water, an alkaline water or with cereal water. The food is gradually increased, but no effort is made to reach a high calory diet; but in prolonged pneumonias, broncho-pneumonias, unresolved pneumonias and complicated pneumonias, one treats them much as he would a typhoid fever case.

Drinks. Water is rarely given in sufficient quantities. It ought to be offered to the patient every hour or two and this particularly as the patient is often so stuporous as not to ask for water that he sorely needs. It is surprising to see how much these patients will take when the water is offered them. It unquestionably affords a stimulus to diuresis, and diaphoresis and keeps the bowels in better condition, lessens tympanites, keeps the tongue and mouth moister and is every way beneficial.

Fruit juices, lemonade, orangeade, imperial drink can be given as freely as water and these latter afford an excellent means of conveying sugar which increases the food intake.

Two to three quarts of fluid a day should be given and, if the patient will take more, three, four or five willingly, he should be allowed it.

Care of the Bowels. Attention to the bowels in pneumonia is almost as imperative as in typhoid fever; for tympanites is almost as common in the one as in the other. The toxins of pneumonia affect the large bowel and its motility characteristically; a moderate grade of paresis of the colon obtains in a very large per cent. of the cases, occurring early in the course of the pneumonia.

The danger that accrues to this condition is entailed by the displacement of the diaphragm upward with consequent encroachment on the thoracic space, favoring congestion, hypostatic pneumonia and lessening the respiratory excursion of the already impaired lung.

The heart, too, undergoes a certain degree of displacement by the crowding upward of the diaphragm and its operation is, consequently, made more difficult.

Stasis, too, in the large intestine favors fermentation which in turn aggravates the tympanites and permits of absorption of products of decomposition and putrefaction which add their own increment of insult to the already toxic organism.

When the case is first seen, then, a catharsis of **calomel** or **salts** should be given. Three quarters of an ounce to an ounce (20–30 Gm) of Rochelle salts or Epsom salts or (and particularly if there be any nausea) small doses of calomel; for example, grain ¼ (0.015 Gm) every ¼ hour until six or eight are taken or in children gr. ⅒ (0.006 Gm) every ten minutes until one grain is taken and this followed in three or four hours by a half ounce (15 Gm) of one of the salts mentioned in a half to three-quarters of a glass of water. Later it is better to rely on the **enema** to keep the bowel in condition; although there is no objection to the use of salts for the same purpose occasionally.

Tympanites. This symptom, because of the danger it entails, must receive attention. It is less marked in those cases that have a sufficiency of water given them.

The **diet,** too, should be inspected with reference to the quantity of fats or milk sugar it contains, either of which may be responsible in some measure for the collection of gases, and should be diminished or eliminated from the dietary.

The enemata themselves offer much relief and their effects are enhanced by the addition of small quantities of the **oil of turpentine.** I use ℥ss–℥i (15–30 c.c.) of turpentine in a pint of soapsuds. One makes a thick lather with castile soap and a small amount of water, stirs in slowly the amount of turpentine to be used and then adds water up to a pint or more if desired.

In this way the turpentine is kept in emulsion. Stupes, too, are to be used for this purpose; for the technique see Typhoid Fever, Chap. V.

Turpentine may, also, be given by way of the mouth in capsules, of 5 to 10 minims (0.30–0.60 c.c.) each or in an emulsion. The disagreeable taste may be covered by adding a suitable amount of cinnamon or some other aromatic substance.

Rectal tubes may also be inserted, just as in typhoid fever.

Shattuck speaks enthusiastically of the efficiency of pure **glycerine** in doses of one to two ounces (30–60 c.c.) for the relief of tympanites.

Strychnine, for its tonic effect on the musculature of the bowel may be used in doses of gr. 1/30 (0.002 Gm) three or four times a day.

A **Murphy drip,** with the bag held about a foot above the bed may be used for the same purpose. The temperature of the saline used should be about that of the body or slightly above and the solution may be kept warm in the bag by applying hot water bottle about it or inserting an electric bulb in it.

Symptomatic Treatment. Before touching upon the individual symptoms I will mention those measures which enhance the functions of the body as a whole, that increase its powers of resistance.

The Open-Air Treatment. I am convinced that there is no measure comparable in its effects on the vital centers to fresh, live air in the open.

The open air to have its stimulating effect or to have its maximum stimulating effect must be cold and dry and in motion. The constant play of the currents of cold dry air, impinging on the nerve endings of the face and the upper air passages send their impulses to the vaso-motor, respiratory and other vital centers acting upon them as stimulants.

Fresh air, alone, desirable as it may be, such as one gets by having the windows of a room or ward open does not give the same results as the air out-of-doors.

As the temperature rises and as the humidity increases the effects of the open air diminish.

Sufficient reports have been made, and my own observations have confirmed them, to assure us that as measured by the improvement in blood pressure there is no drug classed as a circulatory stimulant, the effects of which are so decided, so sustained, as the effects of fresh air.

Not only does the pulse show a better quality and become slower, but the respiratory act is deepened, the nervous manifestations lessened, cyanosis is diminished, and the patient in every way shows improvement.

However, to effect the desired results, a technique is to be carefully observed. The preparation of the bed and the patient in the bed is all important.

When, as is usual, a patient in this treatment is exposed to the winter air, our efforts are directed against any possible chilling of the surface of the body and extremities; for if this occurs our efforts are defeated and our patients may be truly endangered.

The Bed. A half bed, preferable of the hospital type, is stripped to the woven wire spring. Upon these springs is spread a large blanket, extending well beyond the sides of the bed and well beyond the foot. Upon this blanket is laid rubber sheeting or thick papers, that extend beyond the sides and foot as far as the blanket does. Upon these papers is laid the mattress and then the bed is made in the usual way with every care for the smoothness of the sheet and the draw sheet.

The patient, prepared as presently to be mentioned, is placed in this bed and then the blanket and the rubber sheet within it are drawn up around the mattress, bed and patient in such a way as to form a complete envelope and, in fact, folded much as one would an envelope.

The patient has been in the meantime clad in an under suit of flannel, with stockings, and a hot water bottle is placed at the feet. Upon his head is a hood; only his face is left exposed. One low pillow is afforded him. If there be high winds, an effort should be made at affording a shelter by the use of screens or the position of the bed; while some shelter to the head can be procured by the use of pillows on either side of the head, making an inverted letter V. The object of all this is to prevent air getting at the patient's skin to chill him.

The patient must be kept under constant observation, and more particularly if he is in any degree delirious, lest he disarrange his clothes and become chilled or lest in his delirium he leave his bed and injure himself.

Nurses and attendants must be clad for out-of-doors.

For purposes of examination the patient should be drawn into the room and the temperature of the room raised to 65° F. or 70° F. before he is exposed; and the same precaution should be taken when the bed-pan or the urinal is to be used or the toilet of the body performed.

When the conveniences are not at hand for such a treatment, on the verandah or the porch or fire-escape or roof, one substitutes for this treatment a room, the windows of which are wide open or the sash taken out, the window space being filled with cheese-cloth screens.

It is common to see a rise of blood-pressure of 10–20 mm. Hg., or even more, shortly after the patient leaves the ward or room. This will persist until he is brought back into the ward and it is certainly curious, as well as interesting that, although the ward or room, into which he is brought is thoroughly ventilated, the blood pressure will gradually go down several mm. after he has been taken from the open air.

Hydrotherapy. Another therapeutic measure having similar results, effected in a similar manner, is hydrotherapy.

I quote from my article contributed to the New York *Medical Journal* for Jan. 8, 1910.

"Water is used locally (1) to serve the purposes of cleanliness and hygiene in the daily bath; (2) to afford the momentary comfort, cooling the skin and refreshing the patient, and (3) to influence the disease."

This latter is the most important and can be done by means of tub-baths, cold sponging, cold packs, compresses and other devices.

In this country we owe largely to Baruch's persistency what benefit is accruing to us from this mode of treatment. He maintains, and logically, that good results can come only from observance of the technique.

His own preference in pneumonia is the chest compress. I cannot do better than quote his precise directions and urge that they be followed exactly rather than attempt to duplicate measures only vaguely referred to.

"The **chest compress** is prepared by cutting three folds of old linen of a sufficient size to fit the entire chest from the clavicle down to the umbilicus, with arm holes in the region of the axillæ, made by exact measure from one axilla to the other, sufficiently deep to allow the upper edge of the compress to reach above the clavicles and admit of the junction of the flap thus formed on each side to cover the shoulders. Two such jackets and two pieces of closely woven, thin flannel of the same shape, but an inch wider and longer should be provided and fitted to the patient. One of the linen compresses is rolled up and soaked in a basin of water at 60° F. and wrung out so that it remains quite damp without dripping. The flannel is now stretched out upon an even surface and the wet compress put upon it, so that there remains an edge of flannel about an inch wide all around. Both are rolled together half way, while the patient is gently turned upon his left side with the precaution of not allowing any exertion on his part, the compress is so placed upon the bed that the rolled part lies in close proximity to the left side of the patient and the lower edge of the left slit is under the left axilla. Now the patient is quietly turned upon his back, so as to release the rolled up portion. The latter is now unrolled and both edges of the compress are brought upward upon the front of the chest and are thus made to envelope the latter snugly. The flannel cover which has been allowed to lie upon the bed during the application of the wet compress is now brought forward, so as to cover the latter. It is secured by two safety-pins in front and one pin upon each shoulder." He goes on to say that it should fit snugly, but not so tightly as to embarrass breathing. As long as the rectal temperature is above 99.5° F. it is to be renewed about every hour. A fresh compress should always be ready for an immediate application, so that the chest shall not be exposed. Before taking it off, insert the finger beneath the compress to see if it is thoroughly warm as it is not to be renewed if it is still cool. Dr. Baruch further adds: "In the average case a temperature of 60° F. will be appropriate. Should the patient evince stupor or muttering delirium, a lower temperature should be adopted and the chest should receive one or more dashes of colder water before the renewal of each compress. The same procedure is indicated in broncho-pneumonia, when the bronchi are blocked by secretions or cyanosis exists. A higher temperature than 60° F. may be used if there is much jactitation, insomnia or excitability. In the latter event great benefit will accrue from allowing the compress to remain two hours and moistening it more thoroughly before application, thus converting the compress into a soothing fomentation that is not relaxing like a poultice." If the patient remains cold and blue and the compress does not become warm, then the flannel alone is applied until the skin becomes warm and a mustard foot-bath may be utilized.

The rationale of the procedure is put as follows:

It is asserted that "when the cold compress is applied, there is a rapid contraction of the cutaneous vessels, which raises the tension at once, which eventuates in a tonic dilation of these vessels, which is evidenced by a ruddy hue of the skin. This dilation differs decidedly from that relaxed condition of the cutaneous vessels produced by warm poultices. The latter relax the vaso-constrictors, producing a paretic condition of the vessels or a stasis, while cold applications stimulate the vaso-dilators, giving rise to an active dilatation, with maintenance of tone of the vessels, an active hyperæmia, by reason of which the blood is propelled more vigorously through them." The heart is relieved by the increased tone in the vessels. It has been shown that the pulmonary vessels are supplied by nerves rising from the second to the seventh dorsals; the somatic supply is distributed to the skin of the chest and abdomen as far as the umbilicus. Through the effect on this area of the cold compress undoubtedly influences are exerted reflexly on the pulmonary vessels. The improvement is seen in a diminution of the nervous manifestations, deepening of respiration, with relief of dyspnœa; better tension in the arteries, better sleep, improved appetite and freer functioning of skin and kidneys.

Personally, I am not willing to forego the benefit of the open air treatment for the hydrotherapeutic; for one can see that hourly and half-hourly changes of compresses are scarcely compatible with what I have described as the open air treatment. As I have said before I believe that the success of the open air treatment is due in no small measure to the cold; so, in the warmer seasons the cold water treatment could be better applied. Again, where it was evident that the open air treatment was not meeting our expectations, nervous symptoms, excitability, and so forth, increasing, or stupor deepening, we can have recourse to hydrotherapy.

Moreover, the applications of compresses hourly day and night, when a patient needs sleep, does not accord with my definition of rest. I believe that real results can be obtained from the less nagging procedure, with similar results, and with the open air.

Symptomatic Treatment. As has been said, symptoms may be looked upon as purposeful expressions of the body's efforts to accomplish something useful for itself; but that it is possible for Nature in this effort to overshoot the mark and for the symptoms to become, *per se,* a source of danger.

Fever. There is abundant reason to believe that the febrile reaction favors the efforts of the body to kill the invading organism and to protect itself against its ravages. In a frank pneumonia, a certain amount of temperature may be looked upon as a favorable reaction; certain it is that a low temperature, in the presence of a severe intoxication, offers an ominous outlook. A patient, then, with lobar pneumonia, running a temperature from 104° F. to 105° F. requires no interference to affect the temperature itself.

If, however, the temperature rises much above these points or the disease is prolonged and the temperature sustained, **pyrexia,** *per se,* becomes a source of danger and must be combated. There is but one antipyretic that is warrantable under these conditions and that is **cold water.** One may have recourse to the **cold bath,** given after the manner of the Brand bath or its modification, the Ziemssen's bath, or the slush, given in bed, just as described under Typhoid Fever (see Chap. V). It must be remembered, however, that it is our wish only to bring the temperature down below the danger point and that if the patient is too long exposed to the cold, his temperature may become subnormal and he may go into collapse. It is a good rule, then, to remove the patient from the tub, when his temperature falls to 102° F. to 102.5° F. When the cold bath or slush cannot be used, the **cold pack** may be tried; a sheet wrung out of cold water, wrapped about the patient and then the surface of the sheet rubbed down with pieces of ice.

Less effectual are simple **cold sponges.**

Rectal injections of cold water have some value in lowering temperature.

The only justification for the use of drugs for reducing temperature is an environment that does not permit of the use of cold water.

The **drugs** used are those commonly classified as antipyretics; antipyrin, acetanilid and phenacetin (acetphenetidin), and these must be used cautiously because of their depressing effect upon the circulation.

Cough. The cough of pneumonia may be due to bronchitis or to an accompanying pleurisy. In lobar pneumonia there is an abundant pleural exudate as a rule and cough due to it is common. In broncho-pneumonia there is usually a considerable element of bronchitis and this is, of course, a common source of the cough.

For the **cough of pleurisy** the treatment is aimed at a relief of this condition. Rest to the pleural surfaces is of prime importance and this can be attained by **strapping the chest**; thus lessening the movement of one pleural surface upon the other. Next, we have recourse to **local applications,** which are supposed to act reflexly upon the nervous and vascular supply of the pleura to lessen pain and possibly modify the processes of inflammation. They are **counter-irritation** with the **actual cautery,** lightly flicked along the course of the intercostal nerves; the application of **mustard paste** or **plaster**; in children in the proportion of one part of mustard to four or five of flour; in adults, one part in three, to equal parts, left on for ten or fifteen minutes or until the surface is reddened and reapplied at two, three, or four hour intervals.

Heat in the shape of **poultices, fomentations** and the **hot water bottle** or **cold** by application of the **ice-bag.**

Strapping the Chest. If the patient is not too ill he should be in the sitting position in bed. If this position is not feasible, he should lie on the non-affected side.

The plaster to be used is the "so-called" zinc oxide plaster, because the least irritating. A strip about five inches wide that will reach from the axillary fold to the edge of the rib is cut long enough to enclose the affected side, overlapping in front and behind for two or three inches. One end of this strip is applied two or three inches beyond the spine on the unaffected side, the patient is instructed to breathe out and hold the breath, while the operator holding the strip smooth to avoid any wrinkles applies it snugly to the affected side, carrying it two or three inches beyond the mid-line in front. It is sometimes better to use strips two or three inches wide, overlapping them like clapboards on a house; this particularly where the conformity of the chest, much adipose tissue, or the large breasts of a female, make the application without wrinkles difficult or impossible.

If there is much hair upon the chest, this should be shaven before the strip is applied, to facilitate its removal when necessary.

The Application of Mustard. One may use the mustard leaf (charta sinapis), although I think the paste is preferable.

The mustard leaf is dipped into luke-warm water to initiate the elaboration of the oil of mustard, a single layer of gauze applied to its surface and two or three to its back, and applied, the mustard side towards the chest.

The paste is made by mixing one tablespoonful of mustard to two, three, or four of flour with cold water to the consistency of a paste and spreading it nicely on gauze or cheesecloth. This is covered with gauze and applied to the chest. Care must be taken to use cold or luke-warm water, as heat kills the ferment concerned in the elaboration of the oil. The paste is kept on ten or fifteen minutes, then removed and to the skin is applied a layer of sweet oil or vaseline.

If the skin is very sensitive, the white of an egg or a little oil or vaseline added to the paste will make it less irritating.

Application of the Poultice. Take three cups of water and two and one-half cups of flax-seed meal. Bring the water to a boil and add the meal slowly, stirring it all the time with a spoon. When the mixture is so thick that, poured from a spoon it falls drop by drop, it is beaten quickly to make it light and then is spread evenly over a muslin or gauze, being made about one quarter inch in thickness. A margin of gauze of some two inches should be left all around to turn back over the edge of the poultice. The poultice is then covered with gauze, this being cut to have a margin of three inches to fold in and turn under the muslin, between it and the protector. The protector is usually a piece of oil-silk or old flannel, which serves to keep in the heat. A binder is placed under the patient and a poultice is brought to him on a hot plate to keep it warm, the heat is tested against the face of the nurse, to determine that it is not so hot as to burn the patient; it is then applied slowly, so that the heat can be better borne and the binder brought up around the poultice.

The poultice should not be kept on longer than an hour, because it grows cold by that time, unless some device like a Japanese hand-stove is applied to it to keep the heat up. When the poultice is removed, the site of its application is smeared with oil or vaseline and covered with a dry flannel.

Application of a Fomentation. Cut two or three thicknesses of flannel, sufficiently large to cover the chest. This flannel is placed in a crash towel, boiling water poured upon it, the ends of the towel twisted in opposite directions to squeeze the water from the flannel; the skin is smeared with vaseline or sweet oil and the flannels applied with dry flannel outside, all of which are kept in place by a binder. These are renewed as fast as they become cool. Care must be taken that not enough hot water is left in them to drip down upon the skin and burn.

Application of the Ice-Bag. Perhaps the best bag to use is the circular ice-bag with a circular metallic cap. The bottom of the bag is covered with ice cracked to the size of the end of one's thumb; over this is poured just enough water to cover the ice, then the bag is compressed so that the water comes to the surface of the opening, thus excluding all the air. The cap is then screwed on. This exclusion of the air leaves the bag supple and makes it easily applicable to any curved surface. The bag is then covered with a layer of cheesecloth or linen, to intervene between the bag and the skin and the bag is held on by a binder or by a towel. This should be taken off from time to time, at intervals of at least two or three hours, as continuous cold can produce damage to the skin and the underlying tissues. When the bag is taken off, oil may be applied. (For details of these and similar procedures, one should have recourse to such an excellent little book as that of *Practical Nursing of Maxwell and Pope.*)

When these local measures are not efficacious and the pain and the cough is severe, it is necessary to have recourse to some anodyne. Perhaps one of the mildest and most effectual is **codeine**, which may be given in doses of gr. 1/8 to gr. 1/4 (0.008–0.015 Gm) at two hour intervals.

If these are not effectual when given by the mouth they may be given hypodermically.

In the most severe cases, however, it is necessary to use **morphine**. It is well to begin with as small a dose as will be effectual, gr. 1/16 to gr. 1/12 (0.004 to 0.008 Gm). This can be repeated at four hour intervals; and if necessary the dose increased to gr. 1/8, gr. 1/6 or gr. 1/4 (0.008, 0.010, 0.015 Gm).

While the cough due to pleurisy is exhausting and has no purpose in view, the cough due to bronchitis is of very real use to the patient, in that it empties the bronchi of secretions. A certain amount of coughing, then, that effects this end is desirable; but when the irritation continues and induces exhaustion an effort must be made to remove it. This cough is not infrequently relieved by the application of a mustard paste just as described above. Another measure of great value, where the bronchitis is intense and the congestion of the bronchi very marked, in those cases where the narrowing of the bronchi simulate a spasmodic asthma or not infrequently leads one to feel the possibility of œdema, is a vigorous **cupping**, all over the chest. Wet cupping was once much in vogue in these conditions, but to-day is rarely made use of. The dry cupping is the measure of which I speak.

Technique of Cupping. There are special cups made for this purpose, but it is scarcely necessary to obtain these, for any small glass, such as a medicine glass, wine glass, egg-glass will answer. It is desirable that they should be of rather thin glass, lest their own weight should be so great as to displace them. The site of the cup should be cleaned before the application. One produces a partial vacuum in the cup and one of the simplest means is to drop a shred of absorbent cotton into the cup, light it and, while it is burning, invert the cup and clap it upon the part to which it is to be applied.

Another method is to smear the inside of the cup with a thin film of alcohol and light it, again applying while it is aflame. One should be very careful, however, to have no excess of alcohol, as a drop of it running onto the skin may cause quite a severe burn.

Following the application of the cup, the skin is drawn up into the cup and becomes deeply congested; the negative pressure may be so great as to form an ooze of serum on the surface, standing in little drops. This, however, is not desirable, although it does no harm.

The cups remain until the skin looks well congested. In order to take off the cup one depresses the skin at the edge of the cup to let in the air. If the cup is to be reapplied, it must be thoroughly wiped free of the moisture produced by combustion of the alcohol.

The improvement following this measure is sometimes very striking.

Wet-Cups. If the patient is plethoric and cyanotic, the wet-cups may be used with benefit. A special apparatus is supplied for this purpose which consists of an instrument with a small number of lancet blades which, when the instrument is applied to the skin and a spring touched, spring forth and incise the skin.

Over this bleeding surface a dry cup is applied in the manner detailed above, sucking the blood out of the wound, acting as an artificial leech. It is rarely necessary to repeat this procedure.

Inhalations. Inhalations of steam or medicated steam are often found grateful and relieve the cough materially.

For this purpose one may use the common croup-kettle or some simpler substitute on the market or manufacture a device by using a kettle or pitcher with a paper cone to conduct the steam. In children the steam may be led into a tent which is made by throwing a sheet over the four posts or over laths attached to the four bed-posts to give it elevation or by throwing a sheet over an open umbrella under which the child lies.

Medication used in the steam may be either the **compound tincture of benzoin, oil of pine** or **oil of eucalyptus.** One places one or two drams (4–8 c.c.) of such upon the surface of the water. In specially devised croup-kettles, a sponge is placed in the nozzle, to which when moistened the medication is applied; steam circulating through this takes up the medicament and is inhaled by the patient. One of the most effectual inhalations with which I am acquainted is one used by Dr. Francis Delafield and consists of the following prescription:

℞—Alcohol ....
Chloroform ....
Creosote ....equal parts.
S. Put 10 drops of this upon the moistened sponge of a Robinson's inhaler or some kindred device.

The inhaler is a perforated zinc sheet, bent to fit over the mouth and nose and this may be worn by the patient as long as it gives relief.

If these local procedures and inhalations do not afford relief one has to have recourse to sedatives.

Drugs. **Codeine** and **morphine** may be used in the same doses as for the cough of pleurisy.

Personally I have very little faith in the expectorants and in pneumonia never order them.

Those, however, who do believe in **expectorants,** will find in **ammonium chloride or carbonate** the favorites for this purpose and these may be given in 3 to 5 grain (0.20–0.30 Gm) doses every two or three hours. It is often well combined with the syrup of Tolu, e.g.:

℞—Ammonii chloridi	3.00	gr. xlv
Syrupi tolutani	15.00	℥ ss
Aquæ destillatæ q.s. ad	60.00	℥ ii

M. et S. One teaspoonful in water every three hours.

Pain. Pain in pneumonia is a manifestation of pleurisy. It is apt to occur early. Sometimes it is trivial and sometimes may not occur at all.

Again the pain is most intense and lasts for several days.

It must not be forgotten that the pain of pleurisy occurring in the lower part of the pleural cavity or on the diaphragmatic surface, by reflex pain may simulate an abdominal condition, giving rise to rigidity and tenderness that is often confusing.

Local Measures. These are identical with those detailed to relieve the cough of pleurisy; namely, application of heat, the application of cold, counterirritation and cupping. In the severe cases the use of codeine and morphine as detailed above.

Toxæmia. The degree of toxæmia depends in each instance upon the virulence of the toxins on the one hand and the degree of resistance on the other. As we have no means at present of modifying the virulence, unless the use of antitoxins as practiced by Cole and his co-workers have passed beyond the experimental stage into practical usage, we must devote our attention to increasing the powers of resistance. This is effected by carrying out all these measures that have been touched upon; giving the body its maximum rest, giving the body a sufficiency of fuel in terms of food, giving the tissues a maximum of oxygen, as afforded by fresh air and keeping in good order the eliminating organs; that is, attention to the bowels, attention to the kidneys, and attention to the skin; and it must not be forgot that a sufficiency of water intake subserves all these purposes to no small degree.

The use of drugs to enhance these functions, except the use of cathartics as mentioned are indicated only when the organs show a faltering in their functions or when it is known that these organs are impaired in the individual when infected by the pneumococcus.

The effect of toxins on the nervous system is striking and not the least upon the cerebrum; and while it is true that a considerable area of lung tissue may be involved with practically no delirium or stupor, as a rule one or the other obtains to some degree and in a large per cent. of cases to a very marked degree.

Delirium, restlessness and loss of sleep, headache and stupor have all to be taken into consideration. When delirium obtains the patient must be very carefully guarded as the patient may leave the bed, throw himself from a window or otherwise injure himself. It is in the milder degrees of delirium, in which the patient, sick as he is, may show no little craftiness, that the greatest danger exists. This emphasizes the necessity for **watchfulness** when the patient is submitted to the open-air treatment.

The **open air treatment,** however, or the hydrotherapeutic measures described, lessen the degree of cerebral disturbances, while sufficiency of food, water and attention to the bowels add still more to the amelioration of this condition.

The application of the ice-bag has at times a sedative effect.

Drugs. In the milder forms of delirium, **codeine** is sufficient and best administered hypodermically in doses of gr. 1/8 to 1/4 (0.008 to 0.015 Gm). In the more severe forms, one must have recourse to **morphine.** It should be used as sparingly and in as small doses as will accomplish the object. One may begin, then, with a dose of gr. 1/16 to gr. 1/12 (0.004 to 0.005 Gm).

It is possible that in some individual cases the morphine may not be effectual or may aggravate the restlessness. In such a case one may have recourse to **hyoscine hydrobromate** gr. 1/200 to gr. 1/100 (0.0003 to 0.0006 Gm). This drug is not always reliable.

Sleeplessness and Restlessness. For milder grades one may use **bromides,** either dividing the dose throughout the day or giving a larger dose at night. In the latter case one gives in water gr. xxx to ʒi (2 to 4 Gm) of potassium bromide or a mixture of bromides, potassium, sodium and ammonium each gr. x (0.60 Gm).

If the bromides are not effectual, one should try the milder hypnotics, such as trional, sulphonal, chloralamid, veronal, or in alcoholic cases paraldehyde.

Trional, more soluble, more prompt and more active than sulphonal, is given in doses of gr. x–xv (0.60–1 Gm) in a little wine or whiskey or suspended in a warm drink in the early evening and if not effectual the dose may be repeated in two hours.

Chloralamid is another excellent hypnotic, given in doses of gr. xx to gr. xxx (1.30 to 2 Gm), in a cold menstruum, as heat breaks it up. This is given like trional and repeated in the same way if needed.

Veronal is much affected. My own experience with this drug has not been satisfactory.

In alcoholics **paraldehyde** seems to have an especially happy effect. It may be given in doses of 3ij to 3iv. It is soluble 1 in 8 in water and in whiskey or brandy. For ordinary usage the dose is somewhat smaller, but the bad taste and odor on the breath makes it objectionable.

Of chloral, on account of its depressing effect on the medullary centers, I am wary, except in the sthenic period of the fever.

One should not allow the patient's strength to be sacrificed by loss of sleep night after night, while the results of one and another of the milder hypnotics is awaited, but should use the most effectual of all hypnotics, **morphine.**

Just as in delirium, the smallest dose to effect the desired result is given. Begin with a dose of gr. 1/12 to gr. 1/8 (0.005 to 0.008 Gm).

Not too much stress can be laid on the importance of securing sleep. The waste of energy from restlessness is a matter of moment and the evil results of loss of sleep so well known to all of us is greatly exaggerated in sickness.

Headache. The ice-cap or coil may be effectual or bromide in doses of gr. xv to gr. xx (1 to 1.30 Gm).

Coal tars, such as phenacetin, acetanilid and antipyrin on account of their depressant action on the circulation should be used only in the sthenic periods.

For the very severe **headaches, morphine** in small doses is the best drug to use.

Circulation. It is the belief of the present day that in circulatory failure the vaso-motor apparatus is in the vast majority of instances the part affected and that only in a small percentage of the cases is the circulatory failure due to myocardial inefficiency. This, however, does occur and, moreover, the heart may be the seat of myocardial change before the patient is the victim of pneumonia. It is not easy, even by a careful physical examination to determine in a given instance, whether the myocardium or the vaso-motor apparatus is at fault. Theoretically, the differentiation should be of great importance, as on the one hand one would appeal to vaso-motor stimulants, on the other to cardiac stimulants; but practically, it makes very little difference, for the vaso-motor stimulants that we now have recourse to are but feeble assistants at the best, while I am more and more convinced that whether the heart be affected or not, in a given case of circulatory failure, the members of the **digitalis** series are the most valuable drugs under the circumstances.

It is my custom with the first appreciable evidences of circulatory disturbance to begin digitalis.

It is imperative that this drug should be obtained from an absolutely reliable source and that it shall be freshly prepared. It requires from thirty-six to forty-eight hours for this drug to become operative, when administered by the mouth.

One's success, then, depends on promptness of appreciation of the early demand, when this mode of administration is pursued. Personally, I use large doses of digitalis. I have never seen bad results from so doing and an inefficient dose is too commonly the result of timidity. One-half ounce (15 c.c.) of the infusion or m. xxx (2 c.c.) of the tincture is given three times a day and this is continued for three or four days, by which time, in the average case of lobar pneumonia the crisis is at hand.

If one has not had experience with this drug and is fearful of toxic effects, the dose may be discontinued at the end of the third day. I, myself, am guided by the results, in terms of better circulation or by evidences of gastro-intestinal irritation or other toxic manifestations, often continuing the drug for a longer time.

If for any reason the drug may not be given by the mouth, it may be given by the rectum, in starch paste or in warm milk, 4 or 5 ounces, an amount that is readily retained. The dose for the day may be divided into two parts; the injection being given at twelve hour intervals. If when first seen, the circulation is sadly impaired or the crisis is near at hand, I prefer to begin the medication with **strophanthin** in doses of one-half to three quarters of a milligram (gr. $\frac{1}{120}$ to gr. $\frac{1}{90}$) down into a muscle or into the vein.

The preparation with which I have obtained the best results is the strophanthin of Boehringer, handled by Merck, supplied in individual ampules, containing 1 c.c. of a solution of 1 milligram of the glucoside. Following upon this immediately the digitalis medication as outlined above is begun.

The strophanthin effects may be anticipated within two or three hours and usually will continue until the digitalis begins to be operative. In very urgent cases, in whom a satisfactory response does not promptly follow, one may repeat the dose twelve hours later.

If, as rarely occurs, the pulse drops abruptly, becomes irregular, betokening a heart block, atropine in doses of one hundredth of a grain (0.0006 Gm) should be given hypodermically or intramuscularly, which will usually promptly relieve the block, although its recurrence as the atropine effect wears off may necessitate repetition of the doses at three or four hour intervals. This is such a rare occurrence (and I have never seen it in an acute febrile process), that it should not lead one to hesitate in the use of the drug.

I will mention other so-called cardiac stimulants, such as convallaria and sparteine, only to condemn them, as neither their pharmacology nor their therapeutic application has been worked out and in the case of sparteine, we have reason to believe that we are handling a drug which is rather a depressant than a stimulant.

If proper administration of the digitalis series is not provocative of a satisfactory result or if for any reason they cannot be given or, if the demands are urgent before the drug has an opportunity to take effect, one has recourse to the vaso-motor stimulants. Among these may be mentioned caffeine, camphor, strychnine and adrenalin.

My own preference is for caffeine. One can usually demonstrate in the presence of a low blood pressure a fairly constant response varying from 10 to 20, rarely more, millimeters of mercury. This occurs within a few minutes, lasts but a few minutes and the effects, as a rule, are gone in twenty minutes to a half hour and, in a few instances, after a longer period. It would seem to me like the application of a whip to a tired horse. No such sustained effects can be demonstrated as after exposure to the cold fresh air. I give the drug in large doses, gr. iii to gr. v (0.20 to 0.30 Gm) of a double salt either of sodium salicylate or sodium benzoate which are readily soluble in water. This I am accustomed to give hypodermically or better yet intramuscularly at four hour intervals, or in urgent cases, at three hour intervals or two hour intervals. Given in the form of coffee by the rectum, in cases of threatened collapse it is of peculiar value, when its effects are enhanced by those of heat. The action of the drug is upon the vaso-motor centers. How much effect it has upon the heart output has never been satisfactorily determined.

Next to caffeine, I prefer camphor. Of this drug, too, I use a goodly dosage, giving 3 to 5 grains (0.20 to 0.30 Gm) and preferably 5, hypodermically or intramuscularly. The best mode of administration is in a 10 per cent. or 20 per cent. solution in oil. Sesame oil makes an excellent vehicle. This is given at four hour intervals or in urgent cases at three to two hour intervals; indeed, it is my rule when these drugs are needed, to alternate caffeine and camphor in the doses specified, so that one or the other drug is given at two hour intervals.

In strychnine I have but little faith, as a circulatory stimulant. I will not, however, oppose the use of its earnest advocates so far as to condemn it. If the drugs mentioned fail it may be tried, in doses of gr. 1/30 to gr. 1/40 (0.002 to 0.0015) hypodermically or intramuscularly, at intervals of three or four hours.

Adrenalin chloride or epinephrin. Epinephrin is the most powerful vaso-motor stimulant that we have, but its effects are very short-lived. It is indicated in urgent cases or in cases of collapse. When œdema of the lungs prevails it should not be used at all or with extreme caution. Hypodermically its effects are uncertain; intramuscularly fairly certain and then may be given in doses of m. x to m. xv (0.60 to 1 c.c.). Given into the vein its effects are immediate, out of all proportion to its usage elsewhere. Only 3 or 4 minims (0.20 or 0.25 c.c.) should be put into the vein. I have seen a pressure of 60 millimeters rise to over 200 faster than the measurement could follow it, throwing a tremendous and sudden burden on the heart. It cannot take the place of the other drugs for continued usage.

Nitroglycerine, too, has been used, but I decry it, for its physiological action is to heighten the very effects we desire to overcome, for it is a vaso-motor depressant, causing dilatation of the vessels.

Alcohol, too, I condemn, for the reasons specified in Typhoid Fever (Chap. V).

To reiterate, then, success depends on an early appreciation of circulatory distress, the use and liberal use of the digitalis series, aided by such members of the vaso-motor stimulants as caffeine and camphor. I should add that after the patients have been under goodly doses of digitalis, strophanthin should not be used, lest a sudden heart block ensue. Its especial use is to introduce the digitalis series.

Collapse. This accident is more likely to occur at or near the crisis, although it may possibly occur earlier.

The probability of collapse is lessened in those cases where a determination of circulatory embarrassment has been made sufficiently early to meet the demand. When it does occur, vigorous **stimulation** is indicated. **Heat** should be applied to the surface of the body, **hot-water bottles** at the feet, **hot flannels** or **hot cloths** applied to the extremities, sufficient number of **blankets** put upon the patient, **volatile stimulants,** such as the stronger water of **ammonia,** applied to a towel and given to inhale, this in turn followed by the injection of the most rapidly acting vaso-motor stimulants, such as **adrenalin,** in doses of m. xv (1 c.c.) intramuscularly or in lesser doses of m. iii–iv (0.20–0.25 c.c.) into a vein. This may be followed by **caffeine** or **camphor** in doses of gr. v (0.30 Gm) or strychnine, gr. $1/30$ (0.002 Gm), doses into the muscles or a vein for a more permanent effect; these, in turn may be followed by **strophanthin,** gr. $1/60$ to gr. $1/120$ (0.001 to 0.0005 Gm) down into the muscle or into the vein, and this in turn by a **digitalis** medication, as discussed above under a failing circulation.

Heat applied to the bowel is also of importance and may be given in the shape of a **saline irrigation** at 110° F. to which strong black coffee may well be added.

Pulmonary Œdema. Pulmonary œdema means cardiac distress and vigorous measures should be taken at once to relieve it.

If the patient is plethoric, full blooded, cyanotic, much of the burden may be taken off the heart by **venesection** of 12 to 16 or more ounces of blood.

The heart then should be vigorously stimulated with intramuscular or intravenous injections of **caffeine,** in doses of gr. v (0.30 Gm) or **camphor** in the same doses and **strophanthin** in doses of gr. $1/120$ to gr. $1/60$ (0.0005 to 0.001 Gm). **Atropine,** too, may be used in doses of gr. $1/100$ (0.0006 Gm) hypodermically or intramuscularly.

A measure that is often followed by marked improvement is a very thorough **cupping** of the chest in front and behind. (For technique, see text, p. 74.) The best position for the patient is a semi-recumbent one.

Dyspnœa. Dyspnœa may be due to embarrassment of the respiratory center or to shallow respiration induced by the pain of pleurisy. In the latter case our efforts are aimed at a relief of the pain. It is surprising how much lung tissue may be involved without respiratory disturbance, providing the toxæmia is not marked. However, very extensive involvement of the lung must induce disturbance of breathing. It has been most gratifying to see how much respiratory distress is relieved by submitting the patient to the **open air treatment.**

Inhalations of **oxygen** are used for the same purpose. It is difficult to see the rationale of this procedure, but every now and then there is a rapid and convincing improvement, during the inhalation of oxygen. When these measures fail one may have recourse to the respiratory stimulants, such as **caffeine** .in doses of gr. v (0.30 Gm) into the muscle or **atropine** in doses of gr. $1/100$ (0.0006 Gm) or **strychnine,** gr. $1/30$ (0.002 Gm).

Respiratory embarrassment may also be due to pulmonary œdema, when it is to be treated as above specified.

Broncho-pneumonia. It has been contended that the nature of the lesion determined quite a different line of treatment and that broncho-pneumonia should not be treated like lobar pneumonia. I am not quite in accord with this teaching, for it has been my experience that a large per cent. of the cases of broncho-pneumonia have greatly benefited by the open-air treatment. I am, however, appreciative of the fact that broncho-pneumonia is peculiarly prone to attack the aged and the weak. These cases, certainly, should not be exposed to the open air, unless great watchfulness is observed to keep up the body heat.

If the technique of the open-air treatment cannot be well carried out, these cases had better not be exposed. Finally, there is a certain number of cases in whom the cough, instead of being improved is made worse. These cases do better in a warmer air and should be kept in a room with a temperature from 65° F. to 70° F., the air of which is renewed from time to time. This class of cases often do well with **inhalations** of steam or medicated steam, such as has been specified for bronchitis.

Specific Treatment. So much work at the present time, so full of promise is being done that one is sorely tempted to write at greater length on the specific treatment of pneumonia than a work of this character, designed to be definite in its statements and practical in its purposes would seem to warrant. This specific treatment depends on the use of the dead bodies of pneumococci, vaccines, on the one hand or on the use of immune sera on the other.

Studies at the Rockefeller Institute have shown that the pneumococci concerned in the production of lobar pneumonia are not biologically identical; and that they may be divided from this standpoint into four or more groups. Cole and his co-workers, utilizing these various strains for the production of immune sera in animals, have been able by treating cases infected with one or the other group, with it appropriate serum to obtain promising results in two of these groups.

Vaccines, too, have been used and there is some reason to believe that anti-bodies can be induced operative against the various groups named by the utilization of a single strain, the Neufeldt strain or Group No. 1 of the Rockefeller Institute, even when the serum produced from this strain has no effect upon the other groups.

CONVALESCENCE

The period of convalescence appeals to the good judgment of the physician quite as much as any other period of the illness; for the failure to appreciate the possibilities of convalescence may result in immediate disaster or more remote consequences unfortunate for the patient. It must be remembered that after the defervescence resolution must occur, and that the patient should not be allowed to sit up or raise himself up in bed until the resolution is complete, since it is during this period that pulmonary embolism may occur, the result of which is often immediate death, or, if the toxæmia has been profound and the myocardium much weakened, cardiac dilatation may ensue.

If the course of the disease has not been peculiarly severe one may say in a general way that a week after resolution has occurred the patient may be allowed out of bed; but if the toxæmia has been severe and the condition of the circulation during the disease has been a source of anxiety, possible weakening of the myocardium must be kept in mind and the patient be kept in bed for a longer period. He should be allowed to be bolstered up in bed at first, then allowed to get out of bed, then allowed to get about; but each increment of freedom from restraint should be granted only when the heart shows no irritability on the occasion of increased effort.

Complications such as empyema, abscess of the lung, gangrene of the lung, and so forth, of course, prolong the convalescence.

Care must be given to the dietary, sufficiency of food given and the value of fresh air to the convalescent be fully appreciated.

It is often most difficult to restrain the patient from returning to his work, particularly where much is dependent upon his effort. How soon the patient shall be allowed so to do, rests entirely upon the good judgment of the physician and no rules can be laid down for him in this matter, except that a restoration of strength and weight and well-being in the patient are the criteria.

If there has been much pleurisy the convalescence is likely to be prolonged and pulmonary exercises, deep breathing, or blowing into bottles are necessary for the proper expansion of the lungs.

Prophylaxis. It must be remembered that the infecting agent finds its entrance into the body through the air passages.

An examination of the throat and nasal passages of healthy individuals has shown that a very goodly per cent. of such are carriers of the pneumococcus. It is obvious, then, that any abnormalities of the air passages favors a lodgment of the organism and the exercise of their pathological activities. Oral hygiene then becomes of importance, proper dental care of the teeth, the use of a tooth-brush, attention to or removal of hypertrophied tonsils, adenoids or other diseased lymphoid tissue, proper treatment of deviated septum, hypertrophied turbinates and other abnormalities of the nasal passages.

It must be remembered, too, that any lowering of the resistance of the body at large favors infection so that attention to diet, exercise, cleanliness of the body on the one hand and avoidance of undue fatigue, mental worry, dissipation, alcoholism, exposures to cold, failure to change cold wet clothing, are all to be avoided.

It must be remembered, too, that the lessened resistance entailed by another illness favors pneumonia as a complication.

There is no question that a large percentage of individuals carry pneumococcus in the upper air passages. The organism increases in virulency and in infectivity in those people who are suffering from any expression of infection, such as common colds, sore throats, bronchitis and pneumonia. Hence, people in health should avoid unnecessary and immediate contact with the sick, avoid kissing, exposure to coughs, use great care in handling the sputum of patients ill with pneumonia or with bronchitis or common colds, avoid crowded places during periods of epidemics of colds. It must be remembered, too, that those who have suffered from a pneumonia once are more prone to repeated attacks.

Prophylaxis, too, is a function of the State and pertains to Boards of Health, Street Cleaning Departments, Building Departments and all such bodies as have to do directly or indirectly with the health of the public at large, while a dissemination of proper knowledge regarding disease is the duty of Boards of Education, Health Officers, and Medical Organizations.

SUMMARY

Rest.

Rest in bed.
Do not allow patient to turn himself if very ill.

- Exclude visitors.
- Permit no subjects of mental concern to be brought to the patient.

Bed.

- Half or three-quarter bed.
- Hospital type preferred.
- Woven wire springs, firm mattress.
- Bed clothing, sheets and light weight blankets.
- For technique of bed-making see text.

Room.

- Chosen for light and air.
- Stripped of all unnecessary furniture.
- Access to porch or verandah desirable.
- Temperature about 65° F.

Care of body.

- Sponge baths for cleanliness.
- Mouth.
  - Use mild antiseptic solution 2 to 4 per cent. of boric acid.
  - ½ to ¼ strength of Dobell's solution.
- Teeth.
  - Keep interstices free from food, use swabs of absorbent cotton or wooden toothpicks dipped in above solution.
- Tongue.
  - For coated tongue and sordes on lips and teeth use ½ strength of peroxide of hydrogen to soften. Scrape with edge of whalebone and then use above solution.
  - For very dry mouth, equal parts of albolene and 2 per cent. boric acid solution, flavored with lemon juice.
- Fetid breath and marked stomatitis.
  - Phenol, watery solution 1–20.
  - Glycerine .... āā ℥i (30 c.c.).
  - Boric acid saturated watery solution ℥viii (240 c.c.).
- Naso-pharynx.
  - Remove collections with cotton swab on long applicators saturated with above solution.
  - Use sprays of boric acid or Dobell's solution.
- Nose.
  - Soften dried secretions with sweet oil.
  - Cleanse with cotton swab on toothpicks, using above solution.
  - Spray, using above solutions.
  - Avoid irrigations.
- Fissures and herpetic eruptions.
  - Use above solutions and anoint with oil or vaseline.
- Eyes.
  - Cleanse with 2 per cent. boric acid solutions.
- Genitals.
  - Cleanse with boric acid and Dobell's solutions.
- To Excoriations.
  - Apply 1½ per cent. to 2 per cent. phenol solution.
  - Apply and keep dry with dusting powders.

Diet.

- Do not force food during the early hours.
- Do not force food during the high temperature of a lobar pneumonia.
- The longer course of a broncho-pneumonia indicates food of a higher caloric content.
- Milk.
  - Each ounce equals 20 calories.
  - Gravity cream 16 per cent. each ounce equals 50 calories.
  - Milk sugar each ounce equals 120 calories.
  - One may add 1 ounce of cream and ½ ounce of milk sugar to each glass of milk, thus increasing the calories about 100.
- Cereals.
  - Oatmeal.
  - Hominy.
  - Farina.
  - Rice.
  - An ordinary serving of which, of 3 to 5 ounces, equals 100 calories.
  - In addition eggs, cup custard, broths made of cereals and milk, bread and butter.
- Milk preparations such as,
  - Matzoon.
  - Koumys.
  - Zoolak.
  - Buttermilk.
- If the patient much desires it meat soups such as,
  - Mutton broth,
  - Chicken broth to which may be added cereals or rice to add to the caloric value.
- Summary of diet.
  - Early days, small amounts of milk, large amounts of water, and milk better diluted with plain water, alkaline water or cereal water.
  - Increase food gradually.
  - In prolonged pneumonias, broncho-pneumonias, unresolved pneumonias, complicated pneumonias, increase to a high caloric diet.
  - Food may be given at two or three hour intervals.
- Drinks.
  - Give water abundantly.
  - To stuporous or delirious patients offer water every hour or two.
- Fruit juices.
  - Lemonade, orangeade, grape juice, imperial drink may be given freely.

Care of bowels.

- When first seen.
  - Calomel, gr. ¼ (0.015 Gm) every ¼ hour for 6 or 8 doses.
  - In children, gr. ⅒ (0.006 Gm) every 10 minutes for 10 doses.
  - In the adult followed in three or four hours by salts, Rochelle or Epsom, ½ ounce (15 Gm) in ½ to ¾ of a glass of water.
  - In children follow in two to three hours by 4 to 8 ounces (120–

  - 240 c.c.) of Liq. Magnesii Citratis, or ½ to 1 ounce (15–30 c.c) of milk of magnesia.
  - Or salts alone may be used, Rochelle, Epsom or Glauber ¾ to 1 ounce in adults (20–30 c.c.).
  - Or milk of magnesia ½ to 1 ounce (15–30 c.c.) in children,
  - Later enemata of plain water or soap-suds.
- Tympanites.
  - Suspect the fat of milk, or the milk sugar.
  - Cut them down or eliminate.
- Enemata.
  - Plain water or soap-suds, or add oil of turpentine ½ oz. to 1 oz. (15–30 c.c.) to soap-suds enema.
  - For technique see text.
- Rectal tubes.
  - Glycerin rectal injections ℥i to ℥ii (30–60 c.c.).
  - Strychnine for tonic effect gr. 1/30 (0.002 Gm) three times a day or four times a day.
  - Murphy drip. (See text.)
- Open air treatment. (Read text.)
- Bed.
  - Woven wire spring; over this
    1. Large blanket; over this
    2. Rubber sheeting or paper; over this
    3. Mattress, sheets and blankets.
  - Fold 1 and 2 over 3 like an envelope.

Patient.

- Flannel undersuit.
- Stockings.
- Hood.
- Low pillow.
- Pillows for shelter like an inverted V.
- Hot water bottle to feet.
- Screens for high winds.
- Must not be left alone.
- Nurses and attendants dressed for out of doors.
- For toilet, use of bed-pan, examination, draw into room at 65° F. to 70° F.
- For open air treatment may use verandah, porch, fire-escape, roof, room with windows out and screened with cheese cloth.

Hydrotherapy. (See text.)

- Chest compresses, Technique, text.

Symptomatic treatment.

- Fever.
  - Let alone unless temperature is above 105° F. or sustained at about 104° F.
  - Brand bath. (See Typhoid Fever, Chap. V.)
  - Take patient out at 102° F. to 102.5° F.
  - Slush.

Pack.
Sponges.
Rectal injections of cold water.

Drugs.

Only when cold water can not be used.
Phenacetin gr. v
or
Antipyrin gr. iv } Every 2 hours, but cautiously watch pulse.
or
Acetanilid gr. ii

Cough.

Due to pleurisy.
Strapping chest. (For technique see text.)
Mustard leaf or paste. (For technique see text.)
Poultice. (For technique see text.)
Fomentations. (For technique see text.)
Ice-bag. (For technique see text.)
Codeine, gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$ (0.008–0.015 Gm) every two hours.
Morphine (in very severe) gr. $\frac{1}{16}$ to gr. $\frac{1}{8}$ (0.004–0.008 Gm) at 4 hour intervals.

Due to bronchitis.
Its purposefulness. (See text.)
Mustard paste or leaf.
Dry cupping. (For technique see text.)
Wet cupping. (For technique see text.)

Inhalations.

In croup kettle or similar device. (See text.)
Steam, plain or medicated with,
Compound tincture of benzoin,
or
Oil of pine, } ʒi to ʒii (8–15 c.c.).
or
Oil of eucalyptus

℞
Alcohol.
Chloroform.
Creosote, equal parts.
M. et S. gtt. x on sponge or inhaler. (See text.)

Drugs.
Codeine
Morphine } See cough of pleurisy above.

Expectorants. (Too much used, rarely indicated.)

℞

Ammonii chloridi	gr. xlv	3.00
Syrupi tolutani	℥ss	15.00
Aquæ distillatæ q. s. ad.	℥ii	60.00

M. et S. One teaspoonful in water every three hours.

Pain.

- Pleurisy.
  - See measures for cough of pleurisy above.

Toxæmia.

- Rest.
- Diet.
- Air.
- Care of skin.
- Care of bowels.

Delirium.

- Watch patient continuously.
- Open-air treatment or
- Hydrotherapy.
- Ice-bag to head.

Drugs.

- Codeine, gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$ (0.008–0.015 Gm) hypodermically.
- Morphine (if severe), gr. $\frac{1}{16}$ to gr. $\frac{1}{12}$ (0.004–0.005 Gm) hypodermically.
- Hyoscine hydrobromate (less reliable and less safe), gr. $\frac{1}{200}$ to gr. $\frac{1}{100}$ (0.0003–0.0006 Gm) hypodermically.

Sleeplessness and restlessness.

- Bromides.
  - Potassium bromides or mixed bromides, gr. xxx (2 Gm) at night or gr. xv (1 Gm) three times a day.
- Trional.
  - gr. xv (1 Gm) in wine, whiskey or warm drink in early evening.
  - Repeat in two hours if needed.
- Chloralamid.
  - gr. xx to gr. xxx (1.30–2 Gm) in wine, whiskey or cold drink in early evening.
  - Repeat in two hours if needed.
- Paraldehyde (in alcoholics) ʒii to ʒiv (8–15 c.c.) in whiskey, brandy or water (1 in 8).
  - Codeine. } Same doses as in delirium. (See above.)
  - Morphine. }

Headache.

- Ice cap or cold coil.
- Bromides, gr. xv to gr. xx (1 to 1.30 Gm) in water.
- Morphine (severe) smallest doses effectual.

Circulation.

- Digitalis, with the first evidences of a faltering circulation.
- Use infusion ℥ss (15 c.c.) or the tincture m. xxx (2 c.c.) three times a day for three or four days.
- If the stomach is intolerant give by rectum; in starch paste or warm milk (4 or 5 ounces, 120–150 c.c.).
- Give two doses a day at 12 hour intervals, giving ℥i of infusion or ʒi of tincture.

If condition is urgent when first seen.

Strophanthin, gr. $\frac{1}{120}$ to gr. $\frac{1}{90}$ (0.0005–0.00075 Gm).

Into vein or muscle. (A good preparation is that of Boehringer supplied by Merck, coming in ampules, each 1 c.c. = 0.001 Gm Strophanthin.) Repeat not more than once in twelve hours.

Follow this with

Digitalis as above.

In case of heart block see text.

Caffeine.

Use soluble double salt of sodium salicylate or sodium benzoate, gr. iii to gr. v (0.20–0.30 Gm) into the muscle every four, three or two hours.

Camphor.

Use a solution (10 per cent. to 20 per cent.) in oil, e.g., sesame oil, gr. iii to gr. v (0.20–0.30 Gm) of the camphor every four, three or two hours, or

Alternate caffeine and camphor as above at two hour intervals.

Strychnine (less valuable), gr. $\frac{1}{30}$ to gr. $\frac{1}{40}$ (0.002–0.0015 Gm) into muscle every four or three hours.

Sudden collapse.

Adrenalin m. x to m. xv (0.60–1 c.c.) into muscle or m. iii to m. iv (0.20–0.25 c.c.) into a vein.

Heat to surface of body.

Hot water bottles or cloths to the feet.

Heat to bowel by injections or irrigations of saline at 110° F. to which strong black coffee is added.

Ammonia (strong water) on towel flicked before the nose, then

$\left.\begin{array}{l}\text{Caffeine or}\\ \text{Camphor or}\\ \text{Strychnine}\end{array}\right\}$ in above doses into muscle.

then

Strophanthin in above dose into muscle.

Pulmonary œdema.

If patient is plethoric

Venesection of 12 to 16 ounces (360–500 c.c.).

Caffeine, into muscle in above dose.

Strophanthin, into vein in above dose.

Atropine, gr. $\frac{1}{100}$ (0.0006 Gm) into muscle.

Cup chest. Best position semi-recumbent.

Dyspnœa.

Due to pain. (See treatment of pleurisy in summary above.)

Open-air treatment.

Inhalations of oxygen.

Respiratory stimulants.

Caffeine in soluble salt of sodium benzoate or sodium salicylate gr. v (0.30 Gm) into muscle.

Atropine sulphate, gr. $\frac{1}{100}$ (0.0006 Gm) into muscle.

Strychnine sulph., gr. $\frac{1}{30}$ (0.002 Gm) into muscle.
Due to pulmonary œdema. (See above.)

Broncho-pneumonia.

For modification of treatment see text.
Specific treatment.
(See text.)

Convalescence.

Patient should not sit up until resolution is complete.
Allow to sit up a week after resolution is complete.
For management of this period, see text.
Food.
Air.
Return to work. (See text.)

CHAPTER V

TYPHOID FEVER

Etiology. Typhoid fever, which is one of the commonest diseases in our experience, but less common than in the experience of our medical fathers, thanks to the interest elicited by the work of the research scholar and an awakened sense of civic responsibility, is due to the invasion of the body by a definite bacterium, **Bacillus typhosus** of Eberth. The gross lesions are referable to the intestinal canal but they are to be looked upon merely as local expressions of a general infection. This is an important therapeutic concept, as it directs our attention to the individual as a whole and spares us useless effort to medicate the intestinal canal, in the hope of curing the disease. The **mortality** varies in different epidemics and varies in private and hospital practice, but on the whole is in the neighborhood of 15 per cent.

Therapy. We are dealing with a self-limited disease, the cure of which depends on the elaboration of specific bodies by the tissue cells of the patient, a result we have not yet been able to duplicate in the laboratory. This does not mean that we cannot influence the course of the disease. On the contrary, a considerable fall in mortality has come about as the result of skilled care, conscientious watchfulness, competent nursing, and the application of definite measures to the relief of symptoms and complications.

Rest. It would seem almost superfluous in a disease of such import as typhoid fever to insist on rest, but it must be remembered that the onset is slow, and in mild cases, or what at the beginning promises to be a mild case, the patient is prone to look upon it as an indisposition, and the physician may be uncertain of his diagnosis, and in the meantime the patient is on his feet, perhaps attempting to attend to his business, or at least protesting against the bed. These cases are the so-called "walking typhoids." Statistics have shown that these cases do not do as well as those receiving attention promptly, and it is probable that what might have been a mild typhoid attack has been converted, by lowering the resistance of the patient, into a severe or fatal case.

Where, then, suspicion is aroused as to the possibility of typhoid fever, the patient should not be permitted to waste his precious strength while one is awaiting the development of diagnostic symptoms or the result of blood examinations. He should be put to bed at once and prepared for what is likely to be a long siege. Real rest can be obtained only by careful and competent nursing, by the exclusion from the sickroom of all business cares and causes for anxiety, and refusal to make the sickroom a reception room for solicitous friends.

The patient is not to leave the bed to go to the toilet, or even to use a commode, but the bed-pan is to be insisted on. This trouble comes in the early days of the fever. It will be a source of argumentation and contention, but one's dictum must be firm, backed up by a few words of explanation. The need for rest, the need of sparing the tissues useless oxidation, is emphasized by the length of the disease.

Bed. While remembering to conserve the strength of the patient, it must not be forgotten that the strength of the attendant ought to be economized, and in no way can this be done to better advantage than in selecting a bed on which the patient can be readily handled. The ideal bed is the half-bed, or single bed, of a convenient height, with strong woven wire springs and a firm springy mattress. A folded blanket will render the surface smooth. Over the blanket, is to be placed a sheet, a rubber sheet, and a draw sheet. Sheets should be drawn smooth, for freedom from wrinkles and dryness and cleanliness are great factors in preventing discomfort, and, in very sick patients, the formation of bedsores. Over the patient a sheet and a light blanket is sufficient; and one low pillow, not too soft, makes for comfort. The upper sheet should not be drawn too tightly over the feet of the patient, as is often done to improve the appearance of the bed, to the patient's great discomfort.

Room. The best room is the largest room, with the amount of light most gratifying to the patient; with sunshine in the colder months, and shade in the summer months. It should be well ventilated and free from encumbrances. A hardwood floor is best. If there are carpets, they should be protected in the vicinity of the bed, in consideration of contamination with secretions, which may occur in the ordinary handling of the patient. It is very desirable to have a bathroom near at hand, for the convenience of disinfecting and disposing of secretions, as well as for facilitating hydrotherapeutic measures.

If there is a balcony or piazza that may be approached from the room, it meets a great desideratum, for in summer the patient ought to be kept out of doors, and in winter I am convinced of the value of cold air in improving the nervous manifestations and general condition of the patients. I believe we shall use the open-air treatment for all infectious fevers with vast benefit.

The bed should be prepared by placing a blanket on the wire springs, and on this a rubber sheet, each extending well below and on either side of the bed. On these is placed the mattress, on which the bed is made as usual. Over the mattress and its coverings the blanket and rubber sheet are now folded like an envelope, thus preventing the entrance of air under the clothes. A hood is worn by the patient and a hot-water bottle placed at the feet; the nurses are dressed for out of doors.

When there is diarrhea and incontinence of the bowel or bladder, then more constant attention to the bed does not make the open-air treatment feasible. If the patient is very sick or is delirious, a nurse should be in the room day and night, as self-destruction has occurred in this condition.

Care of the Body. If a properly trained nurse is in attendance, she will exercise all those niceties of her profession with reference to the care of the patient's body and comfort, which will usually improve on one's own suggestions, but it is unjust to the patient to take that for granted, and a quiet survey of the situation and inquiry into the methods used is proper. However, all nurses are not properly trained, and all patients cannot afford the attendance of a nurse. Under these circumstances, one must know what should be done; one should write out explicitly what is to be done, and then see that the instructions are comprehended and successfully carried out.

The state of the patient's mouth requires constant attention, lest, from a foul condition, it become the source of infection of the mucous membranes and their lymphatic supply, the tonsils, the ears, and the lungs; and, upsetting the stomach, destroys the appetite. The teeth should be brushed two or three times a day. The mouth should be rinsed with water or boric acid solution (2 per cent. to 4 per cent.), or one of many mild alkaline and antiseptic washes, after each feeding.

Tongue. If there is a heavy coat on the tongue, such may be removed by careful scraping with the edge of a whalebone. Especial care must be taken to get at the back of the tongue and remove thick mucus from the throat. The cotton swab on a toothpick is a ready means of getting at the dead spaces in the mouth, where food may collect and decompose.

If there is much sordes, and there are fissures, a mild antiseptic containing phenol is of value. Here is one recommended for the purpose:

℞—Phenol solution, 1 to 20,		
Glycerin	āā 1 ounce	30.00
Boric acid, saturated solution	8 ounces—M.	240.00

S.—To be used as a mouth wash.

Bedsores. Bits of cracked ice are grateful, and the condition is much relieved if the patient gets enough water to drink. The nose is to be kept clear by the use of olive oil on a swab, to soften dried masses, and cleansing with boric acid solution or mild alkaline solutions. Whether hydrotherapeutic measures are pursued or not, the body is to have a cleansing bath with warm water and soap and the sponge.

The formation of bedsores is the *bête noire* of a good nurse, and this she avoids by constant care of the skin. Moisture about the buttocks is quickly removed, the parts sponged with alcohol or alcohol and water, equal parts, and, if the buttocks have been much soiled, with a mild antiseptic solution—phenol, 1 to 40, for example. If pressure has been long continued, the skin is rubbed to improve the circulation in the part. The parts are then dusted abundantly with a drying powder, like any of the talcum powders used for toilet purposes. The skin of the whole back is treated in this way. Especial attention is paid to the sacrum, the anus, the buttocks, and the heels. The position of the patient should be frequently changed, not only to avoid bedsores, but to lessen the chance of hypostasis in the lungs.

If sores are threatening, rings are used to take the pressure off, but unless used intelligently, they may be more annoying than useful. If bedsores develop, it may be imperative to use a water-bed or air-bed. The excoriated skin may be covered with a drying powder, like aristol, or a bland ointment, like zinc oxide ointment. If more serious sores appear, they are to be treated on surgical principles.

At certain times and in certain places flies are a great annoyance to the patient, and, not only that, but a very real danger to other members of the family or vicinity, by their well-known ability to carry infection from the patient to the food or drink of those about him. Under such circumstances, screens in the room and over the patient are all-important.

This leads naturally to a consideration of the disposition of the secretions and disinfection of the patient's clothes and utensils.

Disinfection. The stools, the urine, the clothes, the utensils, the bath water, the sputum, and the vomitus have all to be taken into consideration. **Stools** may be disinfected by 1 to 20 phenol. At least twice the volume of the stool should be used, the stool well broken up and allowed to stand several hours. Chlorinated lime, too, is used. It must be fresh, as it soon deteriorates on exposure to the air. A 1 per cent. solution is required; or, to avoid making exact solutions, a handful is put in the pan with the stool and enough water to cover and mix it with. Bichloride is not reliable for disinfecting stools. **Urine** is disinfected with 1 to 20 phenol, using one-third to equal amounts. The lesser amount has been shown to be effectual after one and one-half hours' contact. One to 1,000 bichloride, in volumes equal to $\frac{1}{15}$ to $\frac{1}{40}$ of the urine, standing for an hour and a half, is effectual.

Bath water may be disinfected by adding ½ pound of chlorinated lime to a tub (200 liters) of water and allowing it to stand an hour.

Bed linen should be soaked in 1 to 20 phenol for two hours or in formalin, 3 ounces to a gallon, for twelve hours, and then thoroughly boiled. **Bed-pans, urinals, rectal tubes,** and **rubber sheets** can be disinfected in phenol 1 to 20 and allowed to soak in it.

Knives, forks, spoons, and **crockery** can be thoroughly boiled. **Sputum** is best burned; **vomitus** may be treated with phenol and lime.

Mattresses can be disinfected after the disease is over with dry heat, and the room should be disinfected.

The nurses should give tub-baths, wearing rubber gloves and a rubber apron. If given with the bare hands, and, indeed, after handling secretions, the hands should be carefully washed and soaked in 1 to 1,000 bichloride.

It must be remembered that the administration of urotropin by the mouth disinfects the urine, but we should not intermit the precautions just named.

Diet. Everyone who has treated typhoid fever has felt that the most urgent problem he has to meet is the dietary. He has consulted authority with the result that he has come away more bewildered than instructed. He has been urged to maintain a low diet, lest too great a burden be thrust on digestive organs and tissues weakened by disease, or damage be done to the inflamed intestinal wall with the production of hemorrhage or perforation; on the other hand, he has been taught to give the patient great freedom in diet, lest strength be sacrificed as the result of starvation. He has read arguments for liquid food, for solid food, for stimulating food, for bland food, until in his despair he chooses some guide with whom he is more or less well acquainted, copies his directions with slavish exactness, and proceeds to feed all patients by this measure.

We are dealing here with a fever and a long fever, during which oxidative changes must be met, either at the expense of food ingested or of the body itself, and during which extensive tissue destruction is going on as the result of the disease; this must be made good by the food or the deficit will increase continuously up to convalescence, or bring about a bankruptcy, before convalescence can be attained.

The first great fact to be kept in mind in all fevers is that the body demands as much energy and heat in terms of heat units in fever as it does in ordinary rest in health; we will say 33 calories per kilo, or some 2,300 calories for a man of 70 kilos, or 154 pounds; and that as a result of the fever itself, he usually needs some 25 per cent. more, or about 40 calories per kilo, or some 2,800 calories for a 154-pound man. Therefore, he ought to get 2,800 calories to meet this need from his food, unless he takes it out of his own body.

The second great fact with reference to the body needs to be met by the food, is that there must be a certain minimum of protein in the diet. Voit's standard was something over 100 grams per day, but more recent work has shown that even less would do, but that some 70 grams should be afforded. This demands intelligent scrutiny of the food, with the knowledge of its composition, in order that this minimum should be observed; or, what is next in importance, that it should not be too much overstepped.

The third great body of facts, in dealing with diet in fever, are those which inform us of the loss of protein to the body in fever and how to shelter it by the food administered. The wasting after fever, even a short fever, and so emphasized after a long one, is one of the most familiar phenomena of disease. The wastage is, of course, due to loss of both fat and protein, but more especially, from the standpoint of importance, of protein.

The destruction in fever may be assigned to three particular causes: (1) Starvation. There can be no doubt that our patients are, in too many instances, underfed. That this cause for protein loss can in a goodly measure be prevented goes without saying. (2) Fever itself. Pyrexia exerts a destructive action on protein of the tissues, as can be determined by studying the nitrogenous output in fever induced artificially in animals, as in hot baths or by puncture of the floor of the fourth ventricle. In disease, however, it is not always easy to separate it from: (3) toxic destruction, meaning the breakdown induced by the toxins of the infecting organisms, in part autolytic, perchance, but the detail of which is still obscure.

The influences of pyrexia can, to a certain degree, of course, be influenced by hydrotherapeutic and other antipyretic measures. The effect of the toxins, until we have specific sera or other specific measures at our command, however, are not under our control; and yet, it is surprising how near to a nitrogenous equilibrium a patient can be brought, in the face of this toxemia, if supplied with the proper food in the proper manner.

I am indebted to the work of Dr. Shaffer and Dr. Coleman for many statements of facts made here, but they are not to be made responsible for any conclusions I may draw.

In the disease in question wasting is marked. A loss of 10 pounds is slight, but losses of 40, 50, 60 pounds or more may occur. In this loss, nitrogenous tissue takes a large share. Cases in which the nitrogen loss has been studied, show the equivalent of 7 pounds of pure muscle tissue in twelve days, of 5½ pounds of muscle tissue in eight days, and not rarely 1½ pounds of muscle tissue in a day. This loss may mean not only a deprivation to the body of the functions this tissue subserves, but also disturbances, perhaps toxic in character, induced by the effort to catabolize this protein. The nitrogen partition offers similarities to those seen in the toxemias of pregnancy, and, to quote Dr. Shaffer's words, "there are severe so-called toxic cases of typhoid fever which terminate with acute yellow atrophy of the liver, a condition which appears to be closely associated with a particular type of faulty protein metabolism."

This loss can be avoided, to a greater or less degree, by the food. In considering the foodstuffs, fat, carbohydrates, and protein, one would naturally turn to the proteins to make good a loss of proteins, and, indeed, that is necessary, but to no such degree as would be anticipated. There must be enough protein to meet the daily needs under ordinary circumstances—the 70 grams of which I spoke. There may be a slight storage of excess, which does not obtain in health, but if we give a frank excess, it must be destroyed and eliminated by the organism, and more than that in the process of its catabolism, by virtue of what is known technically as the "specific dynamic action," gives rise to a large amount of heat, which cannot be utilized for the purposes of the body, and extra burden is placed to dissipate the heat. The result is that about 140 calories of protein are required to secure 100 calories available for the purposes of the body.

Fat, on account of its well-known tendency to induce digestive disturbances and diarrhea, must be used with this fact in mind and yet it is astonishing how much fat some of the patients will take without disturbance of any kind, and Coleman notes that this tolerance is especially enhanced by the third and fourth week as the temperature declines.

According to the best known investigators in this field, the strongest sparers of body protein are the carbohydrates, and it is upon these that we place our reliance to solve the problem. It has been shown that the absorption of the fats, carbohydrates, and protein in typhoid fever, when severe diarrhea is not present, is very nearly that of normal.

In the feeding experiments carried out along this line of reasoning by Dr. Coleman among the typhoid fever cases in the wards of Bellevue Hospital the carbohydrate selected was milk sugar, because it ferments with difficulty and is less sweet to the taste than cane sugar and more soluble than the starches.

The experiments showed that a nitrogen gain could be attained when the protein intake amounted to 65 to 95 grams, while at the same time the caloric content of the food was high, 4,000 to 5,500, or 60 to 80 calories per kilo; that is, enough protein was used to meet the daily needs and the loss of nitrogen was stayed by the high carbohydrate content of the food. When the same amount of protein was used with 32 calories per kilo, the loss was considerable. When only 16 grams of protein were used, but with 62 calories per kilo, the loss was greatest.

Now, in one of our most recent and authoritative systems of medicine, the diet advised is 4 to 6 ounces of milk every four hours, or 24 to 36 ounces a day; the whites of one or two eggs every four hours, making the whites of six to twelve eggs a day. Taking the larger amounts, and granting that the patients were fed night and day, we should have 730 calories from the milk, and, allowing 60 grams as the weight of an average egg, two-thirds of which is white, we should have in twelve eggs 480 grams. Of the white, 12.5 per cent., or one-eighth, is protein; the fat and carbohydrate almost negligible. That would give 60 grams of protein from the eggs, or 246 calories. These patients would get at the most 1,450 calories, or about one-half their theoretical requirement. Of protein, they would get about 100 grams, a sufficiency, if backed by enough carbohydrate. This diet has been shown, in the Bellevue patients, to be accompanied by a large negative nitrogen balance. There may be theoretical considerations for such a low diet in typhoid fever, but I do not think that they have any scientific basis.

The basis of the high caloric diet as used in the wards of Bellevue Hospital is milk, cream, eggs, milk sugar, bread, and butter. A quart of milk affords 640 calories. A quart of cream (16 per cent.) about 1,600 calories; each egg 80 calories; milk sugar about 120 calories to the ounce; white bread, homemade, about 1,225 to the pound—that is 100 calories to a thick slice of 1¼ ounces; butter about 3,600 calories to the pound, or 100 calories in a pat a trifle under ½ ounce. With such materials various combinations may be made: 1½ quarts of milk will give 1,000 calories, a pint of cream 800, ½ pound of sugar about 1,000 more, four eggs 320 more, thus making 3,120 calories. If one wants a few calories more, 250 to 500 can be gotten in 2 to 5 ounces of sugar added to lemonade.

A glass of milk that contains 7 ounces of milk, 1 ounce of cream, and 1 ounce of milk sugar, offers about 310 calories.

Eight such glasses in twenty-four hours will give about 2,500 calories, as high as many care to go. The protein, as well as the calories, in this food must be remembered. The milk contains 35 grams to the quart, and the cream a trifle less, 25 grams; the eggs 8 or 9 grams; the bread, about 9 per cent., or 45 grams to the pound loaf. In the more liberal dietary just suggested, about 100 grams are afforded; in the smaller, 70. Two eggs added to this would increase the protein to 85 grams.

Dr. Shattuck, of the Massachusetts General Hospital, has long advocated a more liberal dietary in typhoid fever, and can point to quite as good results as the advocates of a restricted or milk diet. I will not cite his dietary in full, but will mention some of its items, which show one how varied we can make our patient's food and relieve a monotony that threatens a loss of appetite and gastro-intestinal disturbances. These are milk and the various milk products, some of which are better borne than others, such as buttermilk, koumys, matzoon, whey or milk with tea, coffee, or cocoa; or the milk can be diluted with lime water, Apollinaris, or Vichy; soups of beef, veal, chicken, tomato, potato, pea, bean, or squash, strained and thickened with powdered rice, arrowroot, wheat-flour, barley, or egg; gruels, ice-cream; eggs, soft boiled or raw, or eggnog; finely minced lean meat or scraped beef, soft crackers with milk or soups, soft puddings, soft toast without crusts, blanc mange, wine jelly, apple sauce, and macaroni.

Many of these articles have a low caloric content, and would not serve the purposes of our new teaching, but they show what is safe and what may be used to diversify the dietary.

Each patient must be carefully studied with reference to his dietary. We can make a mathematical problem of his food needs, but not of him. If he is highly toxic and stuporous, if he has gastrointestinal disturbances, we cannot expect him to ingest or digest the same quantity and quality of food that he would if his disease was of a milder type. We wish to avoid the older policy of frankly starving our patients, while we at the same time do not desire to stuff them like a Christmas goose, willy-nilly. I believe if the patient is moderately or severely ill when he comes under our observation, we should begin on milk for the first twenty-four hours, some two quarts; then a little milk sugar, a dram to a glass, and rapidly more as he shows that he handles it well; and at the same time or shortly after, a little cream—a half ounce to an ounce to a glass, watching this with especial care; eggs, gruels, or soups, bread or toast or crackers, ice cream, cup-custard, or other milk modifications. If the milk is not well borne, milk preparations, such as koumys, matzoon, buttermilk, or whey, may be used.

If the tongue is coated, if there are eructations, or if diarrhœa sets in, the cream should be stopped and the milk skimmed. Of the meat soups, one may say that they have little caloric value, but may improve the appetite. The scraped or minced meats may be allowed, if greatly desired, but they are not an economical form of food in fever, owing to their high "specific dynamic action," and should not be given in the severe toxic cases, as it is believed, on fair grounds for such an assumption, that the liver in some of the cases is impaired and unable to metabolize the protein of the food brought to it, in the normal manner.

At any rate, in such cases the urea nitrogen decreases while the "rest nitrogen" increases, and the giving of meat aggravates the condition and furnishes us in the convalescence of severe cases the so-called "febris carnis," as Ewing and Wolff believe.

I believe a patient should be given as much food as he will take and handle well. If he will take 4,000 calories, he should have it; but with the earliest signs of gastrointestinal disturbance or disgust for food, one should diminish the food, and do so promptly. The patient's appetite is a valuable guide, and within the range of food mentioned, his likes and dislikes should be considered.

For a veritable mine of information on this subject in both its theoretical consideration and practical applications, Dr. Coleman's article in the *American Journal of the Medical Sciences,* Jan., 1912, should be consulted.

Water. Water should be given to the patient ad libitum and more than that, realizing that in his stuporous condition the patient's demands are no measure of his needs, water should be offered to the patient frequently, every hour or two. For this purpose the bent glass tube should be used, but in highly stuporous conditions the water must be administered with a spoon. A patient should be given 2 to 3 quarts of fluids a day and as much more as he will willingly take. Not only is the intake of water necessary for his metabolic needs, but the functions of kidney and skin are sustained by it, while the condition of the mouth is improved by it and constipation much lessened. Other drinks—lemonade, and orangeade and imperial drink may be given and these offer excellent vehicles for sugar, a highly important food-stuff.

Alkaline waters may also be used.

Hydrotherapy. If one had a brief to hold for hydrotherapy, he could not do better than to appeal to its application in typhoid fever. So thoroughly convinced is the American practitioner of its great value in this condition that arguments to maintain this thesis are only of historical value. The mortality of typhoid fever, vary as it may in different epidemics, hospitals, and localities, has, under the old expectant treatment, amounted to 15 per cent. the world over. Since the introduction of the cold water treatment, where large numbers of cases can be collected, as in great hospital services, the mortality has been cut in half, running about 7.5 per cent. with wonderful uniformity in the hospitals of our larger cities. Statistics have no value unless applied to large numbers. For example, in a certain hospital 100 cases of typhoid were treated by the bath, with a mortality of 1 per cent. One might have attributed this success to some perfection of technique not prevailing elsewhere, but when the same clinician had collected 400 cases his published mortality showed 7.8 per cent., or that of the general experience.

The hydrotherapy of typhoid fever, as universally adopted in this country, is based on the **Brand bath,** or a modification of it, and the greater the modification, the less successful it seems to be. Two emphatic statements with reference to this bath should be made: (1) The essence of the bath lies in the application of cold water and friction, neither one nor the other alone, but both; (2) the purpose of the bath is to improve the condition of the poisoned centres and organs: the heart, lungs, kidneys, and centres in the brain and medulla; incidentally, and to a degree beneficially, to reduce temperature. The last is too often put first, which in this instance does not have biblical justification.

Method. The body should be immersed to the neck; the bath should be given preferably in a tub. In hospital practice, a portable tub on wheels is used. In private practice this is, as a rule, too cumbersome, and a tin bath tub may be used, elevated to nearly the level of the bed on wooden horses, blocks, or other contrivance. Placed alongside of the bed, the floor being protected by a rubber sheet, oilcloth, or carpet, it is filled three quarters full of water, with buckets, or a hose attached to a tap, if one be conveniently near.

The patient's nightshirt is removed, his genitals covered with a napkin, bound about the body, or the whole body covered by a sheet, under which he is bathed, which latter method is a little more awkward. He is given a half ounce of whisky, or a cup of hot strong coffee (4 ounces), the face bathed with cold water, a folded bandage a couple of inches wide, bound around the forehead and tied below the occiput, to keep the water applied to the head from running into the eyes and streaming down the face, and he is then ready to be lifted into the bath. To do this, the best way is for one attendant to rest the patient's head on one arm while he raises the upper part of the body by lifting under the shoulders, while another attendant lifts the lower extremities, the patient being requested to stiffen himself out.

Another method, which has advantages if the patient is very stuporous, is to spread a hammock netting under him or a strip of canvas with straps attached, and lift him on this into the tub and by the same means out of it. The head should rest on a water-cushion ring or air-ring.

As soon as the patient is immersed in the bath, the equally important part of the procedure is begun—the friction, gently applied (not kneading) to all parts of the body except the abdomen. The back must not be forgotten. At intervals during the bath, cold water, at 50° F., should be poured over the head. While in the bath the bed should be prepared for his reception, by placing on it a double blanket, on the side he will occupy; a pillow is covered with a towel, the blanket is covered with a linen sheet, and hot-water bottles are placed at the foot.

The patient is then lifted onto the bed, the napkin is removed, and he is surrounded by the sheet, the edges and ends being tucked about the neck and under the arms. He may be allowed to lie in the sheet for five or ten minutes and then dried with soft towels, or more immediately if the temperature is low and he is shivering. The tub is best emptied by a siphon.

The temperature of the water Brand set at not more than 70° F., and not less than 65° F. The frequency he advised was every three hours, if the rectal temperature was above 102.5° F.; the length of the bath, fifteen minutes. These rules laid down by Brand have met with but slight modifications where satisfactory results are obtained. Slightly lesser temperature of water is used at times, a little higher temperature of the body taken as the indication of the bath, and the initial bath begun at a milder temperature; that is, the tub bath may be given at 80° F., and in selected cases as low as 70° F. the bath is continued fifteen minutes, and given every four hours, if the rectal temperature is 103° F.

Sometimes the tub bath is given at 85° F. for ten to fifteen minutes, at four-hour intervals, if the body temperature is 102.5° F.

It is fully appreciated by the advocates of the Brand system that the reaction to a bath at 65° F. cannot be anticipated in markedly toxemic cases, so that a patient seen in the third week or latter part of the second, who is very toxic, should be subjected to a bath of higher temperature (75° F. or 80° F.), and for a shorter time. Our hospitals rarely get patients in the first week, and the higher temperatures adopted are better suited to their class of cases.

If a tub bath cannot be obtained, a **substitute** for one can be constructed in the bed by running a clothesline around the bed, at a suitable height above its level, attaching a rubber sheet to it by clothes-pins, thus making a tub of the sheet. Other contrivances can be resorted to, to approximate a tub in the bed, as building around the sides and foot and head with rolled blankets, and the use of the rubber sheet as the receptacle for the water. When the patient is put in the water one expects a sudden shock, deep breath, and gasping. These are in themselves beneficial. The patient may shiver, the skin may be shrivelled, and the nails cyanotic, and yet not contraindicate the bath; but if the face is cyanotic, shivering marked, and chattering of the teeth occur, and the patient does not react well on being taken from the bath, then the next bath should be at a higher temperature and less long. Cyanosis of the face or threatened collapse should lead to immediate removal of the patient, warmth to the body externally and internally, and stimulants—hot coffee or hot whisky.

Many untoward symptoms in the bath are due to failure to appreciate the value of, and failure to apply properly the friction during the bath.

The benefit derived from the bath is very obvious and is expressed by improvement in the functions of various organs. No benefit can be expected from any procedure applied to the moribund, and the greatest success in the treatment of typhoid fever by this method is in the early application of it. Many of the severe symptoms seen in cases coming under observation or treatment late, are not observed at all in the cases bathed the first week. The most characteristic effect clinically of typhoid fever is the toxemia impinging on the brain, inducing restlessness, sleeplessness, delirium, stupor, and subsultus tendinum. The stimulating effect on these centres, receiving sensations pouring in from every point of the periphery and nourished by a better blood supply, is shown by an amelioration of every one of these symptoms, better sleep and more quiet, and a clearer mind more alive to its environments.

In typhoid fever the pulse is slow; when rapid, ominous; it is often dichrotic, bespeaking a low vasomotor tone. We stand in dread of heart failure, but the opinion prevails to-day that in acute infectious diseases the heart rarely fails, but that the vasomotor apparatus is the first to falter.

After the tub, the pulse is smaller and harder, losing its dichrotism; the pressure increases by 15 to 20 mm. Hg., and the rate falls. All this is very real, and may be attributed, in all probability, to the effect exerted on the vasomotor centres, though the tonic effect on the vascular walls of the periphery is undoubtedly a factor.

On the respiratory apparatus a beneficial effect is exerted by the fact that the contact with the cold water causes the patient to take deep breaths, which lessen the danger of passive congestion and hypostatic pneumonia that threaten in severe cases. More than that, the respiration of the tissues is enhanced, as increased oxidation can be demonstrated by measuring the oxygen intake and the CO_2 output.

The contact of the cold water and the friction improve the circulation in the skin and so improve its functions. The improved condition of the circulation increases the elimination of urine and the toxins of the disease. The temperature is lowered, but this is no longer considered the object of the treatment, and often in the height of the disease the temperature is not influenced, but striking improvement in the general condition is attained, in terms just given.

After all, it is the individual that is being treated, and this means that a precise procedure cannot be the optimum for every case. Higher temperature of the water and shorter baths are required for those who stand the shock of the typical bath poorly, for those toxic and advanced in the course of the disease, and for children.

Contraindications for the baths comprise hemorrhages and signs attributable to perforation or peritonitis, all of which conditions demand absolute rest until the proper procedure, surgical or otherwise, can be carried out. Cholecystitis, phlebitis, pleurisy, if accompanied by considerable pain, contraindicate the bath for a like reason. Cyanosis and syncope demand cessation of the bath in which they occur, but if the case is a severe one, the use of water may be continued in a milder form of application. Large bedsores, because of the difficulty of properly treating them, contraindicate the bath. Bronchitis, pneumonia, the milder grades of kidney involvement, and menstruation and pregnancy do not call for a change of procedure.

Ziemssen's Bath. Beside the full bath of Brand, there are certain other methods of applying water in this disease. A slight modification of the Brand bath is the so-called graduated bath of Ziemssen. The details are the same as for the Brand bath, except that the water is warmed to 90° F., and then, after the patient is in the bath, is cooled down to 70° F. by adding cold water as the bath proceeds. The bath lasts half an hour with friction. This is a suitable procedure for those who stand the bath poorly, or think they do, and refuse the colder bath, or the very toxic cases of the later stages, or children.

Slush. When, for any reason, it is not feasible to use the tub, an approximation to the methods and results of a tub are attained by what is sometimes called a slush. The patient is stripped, a rubber sheet of ample proportions is put under him, the edges of which are elevated by pillows and blankets folded to the formation of a trough. Water is poured into this trough and the patient given a bath with friction, as in a tub, while cold compresses are kept at his head. The water, of course, becomes warm rapidly and is kept cold by adding bits of ice. The temperature cannot be so accurately regulated as in the tub. The head of the bed is elevated, the water drained off, the patient rubbed with a little alcohol, or alcohol and water, after drying and removing the rubber sheet, and then dusted with talcum. These slushes may be very effectual when properly given.

Packs and Sponges. When the baths are refused, or for other reasons cannot be given, packs and sponges may be substituted; but, while these afford comfort and do some good, they fail in the general stimulating effect that comes from the friction of the body immersed in cold water.

Care of the Alimentary Tract. In the routine treatment of typhoid fever there are no organs whose functions have to be so jealously guarded as those of the alimentary tract, not only because failure of digestion and absorption threaten a fatal issue in so long a disease, but because insufficient elimination and excretion heighten the toxemia, and because diarrhœa exhausts and hemorrhage and perforation await upon the advance of the local lesions. Constipation is almost constant in typhoid fever as we see it in New York. Diarrhœa, which one might gather from any of the text-books as characteristic, is rather the exception.

Catharsis. If seen early, a catharsis of **castor oil,** 1 ounce (30 c.c.), or **Epsom salt,** 1 ounce (30 Gm), may be given. If seen late, all catharsis should be avoided. **Enemas** of tepid water, of soapsuds, or, in obstinate cases, soapsuds with an ounce of sweet oil, or castor oil, should be given every other day. It is the lower bowel one wishes to empty, not the upper, and this can be done effectually with the enema. The upper bowel, the site of the lesion, like any other inflamed part, should be given as much rest as is compatible with its physiological functioning.

The lower bowel is physiologically differentiated; the lower part forming the reservoir for undigested food, and, what is more important, the excreted matter, the nitrogenous content of which forms an almost constant portion of the total nitrogen output; it is, too, the site of active bacterial action, and is an absorbing surface. We wish to avoid absorption of toxic material of bacterial action, which may add its burden to the already overloaded blood. Nothing is more surprising than the large stools obtained from patients on a milk diet, and still more, the considerable movements obtained when patients are taking little or no food. The patient's plea to avoid the enema that he has taken nothing, therefore, can have nothing to evacuate, must be met by explanation of the physiological fact and demonstration of its accuracy.

Tympanites, to some degree, is almost constant, but when marked is usually the expression of the severity of the intoxication. This paretic condition of the bowel, which allows the collection of large quantities of gas, is rife with danger, as it increases the chances of hemorrhage and perforation, and interferes with respiration and cardiac action; pain may be an accompaniment. The free use of water, the attention to periodical evacuation of the bowel, and the general tonic effect of the baths, lessen the severity of this complication.

If milk sugar is being used freely, this should be suspected and cut down or eliminated until its responsibility is determined and the condition relieved.

When in spite of such precautions, it does obtain, the following measures may be carried out:

1. **Introduce** for a distance of 12 to 15 inches into the bowel a soft, pliable **rubber catheter,** taking great care not to use force. The larger bowel is, as a rule, more implicated than the smaller. This will at times permit the escape of considerable amounts of gas. It should be left in ten to twenty minutes, or even a half hour, and may be repeated every two to four hours, as indicated. Turning the patient while the tube is in place may facilitate the escape of gas.

2. The use of **stupes.** Two or three thicknesses of flannel are wrung out of hot water, as dry as possible, and applied every three or four hours. The technique is as follows: A flannel roller is put under the patient, the abdominal wall smeared with vaseline, the stupes applied, the edges being turned under to prevent dripping; oil silk applied, and the roller brought up over the stupes in the manner of a binder. This should be changed every two or three minutes for ten or fifteen minutes, or every ten or fifteen minutes, for several hours.

3. **Turpentine.** There are three ways of administering turpentine to relieve this condition: First, in the stupes, by adding a dram of turpentine to the hot water into which the flannels are to be

dipped; by sprinkling the stupes with turpentine; or by very lightly passing a bit of absorbent cotton wet with turpentine over the abdomen before applying the stupes. Care must be constantly exercised not to irritate or burn the skin. Careless application of the turpentine will certainly entail such trouble. The second method is by giving turpentine enemas. One-half ounce to an ounce of turpentine is to be used in one pint of soapsuds enema. The method is as follows: Take a little hot water and a piece of Castile soap; make a thick soapsuds; add the turpentine slowly, constantly stirring. This makes an emulsion. Add the pint of water, and the emulsion remains stable. Oil enemas are made in the same way. The third method is by the mouth; 10 to 20 drops are used every four hours. It is sometimes dropped on loaf sugar, but the turpentine makes the sugar tough and not easily soluble. It is better given in capsules, 10 minims each (0.60 c.c.), or in emulsion, to which a little oil of cinnamon may be added as a flavor, while at the same time it adds to the effect of the turpentine. Thus:

℞—Olei terebinthinæ rectificati	10	ʒijss
Olei cinnamomi	q.s. (or 3)	q.s.
Acaciæ	q.s.	q.s.
Aq. destillatæ q.s. ad	60	℥ij
M. et fiat emulsum		
Sig.—One or two teaspoonfuls.		

Sometimes a large flat ice-bag or the ice-coil, brings relief, and if all these measures fail, a hypodermic injection of eserine salicylate or sulphate (1/50 grain) (0.001 Gm) may be tried. The diet should be materially decreased, milk stopped, and albumin water administered, and water given freely, if the condition is severe.

Diarrhœa, fortunately, is not a common complication in typhoid as we see it here. Two or three loose movements a day do not call for interference, except in the matter of **regulation of food.** The food and neglect of the bowel may be the inciting causes. If the patient is on a milk diet, the fat is more likely to be responsible for the diarrhœa than any other constituent of the food, and should be removed. Scalding the milk may help. If the diarrhœa is severe, the food should be cut down. Of the astringents, **bismuth** is the best, and should be given in sufficient doses (30 grains) (2 Gm) every two or three hours. This must not be kept up too long, or if administered over a long period, it must be remembered that the bismuth may be retained in the bowel in such quantities as to produce irritation by sheer weight, while the diarrhœa still continues; hence, the necessity for irrigations.

Prolonged saline irrigations, by improving diuresis, lessening toxemia, and keeping the bowel clear, may be of distinct advantage. It is tempting to use **opium,** but it cannot be too emphatically insisted upon that by so doing, pain, the earliest and most important symptom of perforation, may be lacking—to the patient's undoing. It should not be used unless exhaustion from diarrhœa and increasing danger of hemorrhage and perforation from peristaltic unrest seem to demand it. Then one may give a few large doses, rather than long-continued small ones; for example, a pill of opium ($\frac{1}{2}$ grain) (0.030 Gm) every two hours for three or four doses, or some such marked astringent mixture as one of our well-known clinicians has advised:

℞—Pulv. opii	0.25	(gr. iii$\frac{3}{4}$)
Pulv. camphoræ	1.00	(gr. xv)
Plumbi acetatis	3.00	(gr. xlv)
Bismuth. subnitrat.	30.00	(oz. j)

M. et div. in chart. no. xv.
Sig.—One every four hours.

Gastric distress and vomiting are not common. If vomiting does occur, both fats and milk sugar should be suspected and these eliminated from the diet until the symptoms subside and then reintroduce cautiously. **Cracked ice,** in small pieces, sucked, may be of avail. Then try a mild **mustard paste** to the epigastrium, one part in four of flour. If these do not succeed, try a bland powder of **cerium oxalate** (3 grains) (0.20 Gm), **sodium bicarbonate** (5 grains) (0.30 Gm), and **bismuth subnitrate** (10 grains) (0.60 Gm) every two hours. If very severe, cocaine hydrochloride ($\frac{1}{5}$ grain) (0.01 Gm), in tablet form, or one teaspoonful of 0.1 per cent. solution every two or three hours. Finally, **stomach washing** may succeed when other measures have failed.

Hemorrhage. Few things are more trying than meeting the danger arising from **hemorrhage** and **perforation.** Few occurrences demand more judgment and common sense than treating the hemorrhage of typhoid. To judge by the advice given by some authors, the appearance of hemorrhage is to be treated like an invading foe, to be met with every weapon at our command, from stiletto to bludgeon; while more timid counsellors urge letting it severely alone, lest by interference we come off worse than before. It is interesting to note that many competent clinicians both of the past and present have conceived the idea that in non-fatal cases of hemorrhage actual benefit accrued to the bleeding, in terms of improvement in pulse, temperature and general condition, and Rudolph finds authority for the statements that bleeding brings about an increase in the urine, increases the intake of oxygen, hastens coagulation time and enhances the production of anti bodies in the blood. These facts have suggested venesection in severe cases of typhoid and the measure has actually been carried out, but with what benefit I am not competent to state. In the first place, in the early stages, a little blood may appear in the stools, resulting from an oozing of the hyperemic patches, and such small amounts at such a period need no treatment.

In the latter part of the second week, and during the third, we are anticipating the hemorrhages of real significance from the ulcers and know that they do occur in about 7 per cent. of the cases. If the hemorrhage is mild, that is, small in amount, or well borne by the patient, we may have no premonition of it until the stool shows the red blood of the recent bleeding, or the tarry stool of one occurring some hours before.

In these cases, the present bleeding is of less importance than that which may occur later, so that our treatment is largely prophylactic. We **cut down the food,** we enjoin absolute muscular **rest** on the part of the patient, and turn him gently when required.

We may apply a light flat **ice-bag** or **coil** to the abdomen. We may give **calcium lactate** in doses of 10 grains (0.60 Gm) three times a day, and in the light of our recent knowledge of the effect of **horse serum** on coagulation, we may give a dose of 10 to 20 c.c. of it; or, failing that, diphtheria antitoxin in similar amounts. To get the best results from the serum, it should be as fresh as possible. The old serum loses much of its potency in this respect. If fresh horse serum is not available, fresh rabbit's serum may be used. **Human serum is the best of all** (Welsh).

Antitoxin, because it is likely to be old, is less valuable, and when a concentrated antitoxin, made from the globulins, of no use at all. The same precaution must be used in administering the serum for this purpose as when giving antidiphtheritic or antitetanus serum, to avoid the results of anaphylaxis. To prevent this, a dose of 10 minims is given, which will be enough to produce sufficient evidences of anaphylaxis if it exists, but not a fatal result. If no manifestation appear in a half hour, the full dose may be given with more assurance. An initial dose of serum after a matter of ten days might possibly establish an anaphylaxis, and this precaution is doubly necessary, when a second dose is given after such an interval. Immunity against anaphylaxis may be established by giving doses of serum —full doses—every day, or second day.

If the 10 minims cause anaphylactic manifestations, wait a couple of hours and give another 10 minims, and a third and a fourth at the same intervals. If no further symptoms appear, the large dose may be given.

If, however, the hemorrhage is **severe,** as shown by the large quantity of blood passed by the bowel, and even more if general symptoms of hemorrhage prevail, with or without the passage of blood—that is, sudden fall of temperature, pallor, cold sweat, cold extremities, rapid thready pulse, restlessness, and air-hunger, more decided measures must be taken. There is one drug that is of greater value than any other, namely, **morphine.**

It is to be given in doses of ¼ grain (0.015 Gm) under the skin. Morphine is not a styptic, nor has it any effect on the caliber of the vessels or coagulation time, but what it does do is to afford the maximum amount of rest, both to the bleeding bowel and to the anxious brain, and to the restless and uneasy body, whose useless movements keep up the blood pressure. This gives the bleeding vessel a chance to do what it is trying to do—form a clot. It is pointed out that perforation occurs in these hemorrhages—one-fifth of the perforations; and that the use of opium blinds the symptoms, and no doubt it does, but, while anticipating such a complication, we cannot sit by and see our patient die from the hemorrhage.

There are many cases that come between these two extremes, and success in those cases is the fruit of experience and judgment. One can only say, when a patient is to be under constant observation for some hours to come, as he ought, hold off the opium as long as possible. If circumstances will not permit remaining by the patient, one should not spare the opium.

The bowels should not be moved for some three days after a hemorrhage, and then with caution. One should get back on the diet slowly and combat meteorism.

When the hemorrhage causes **exsanguination,** it must be treated like any other hemorrhage—**elevation of the foot of the bed, heat to the extremities, saline infusions** of 0.9 per cent. sodium chloride solutions, or better yet, Ringer's solutions or **transfusion.**

The newer methods of transfusion as described by Lindeman (see *American Jour. Diseases of Children,* Vol. 6, No. 1, July, 1913) and others have so simplified transfusion and so robbed it of the dramatic that the process should be used whenever hemorrhage is repeatedly persistent or dangerously severe.

The essence of the procedure is a rapid transferal by syringe from the vein of the donor to the vein of the patient.

Tests of the blood to determine its congeniality to the recipient must be made first, lest hemolysis ensue. The method is so simple that the transfusion can be repeated as often as needed. Moreover, there are reasons for believing that in a healthy individual a certain amount of anti-bodies are present and certainly complement, which may be diminished in the patient's blood and its replacement thus have an additional beneficial effect on the patient.

Perforation. Even more dangerous than hemorrhage is perforation. It occurs in 2 to 3 per cent. of the cases and causes some 12 per cent. of deaths in typhoid fever. It seems to occur as frequently in cases treated with the bath, but because of the lower mortality of the disease so treated, the percentage of death from perforation rises. If one in eight or more of the deaths in typhoid fever are due to perforation, it becomes a moral obligation to know the signs well. One will recall the sudden onset, with acute abdominal pain, like a bolt out of the blue; its paroxysmal character, the rapid rise in the leukocytosis, the two most important early symptoms, I think;

then the change in respiration, rapid pulse, distressed expression, local muscle spasm, rigidity, tympanites, with, perhaps, obliteration of the liver dullness.

Every attack of abdominal pain should mean perforation until continuous observation convinces otherwise, for thus its occurrence will not be overlooked. When it occurs, the surgeon should be summoned, an operation performed, and the perforation closed. If satisfied that pain has no such significance, one should consider the possibility of acute cholecystitis. Carter, studying 1,815 cases of typhoid fever, found that in one in 75 abdominal pain had this explanation. It requires the same consideration as under other circumstances and may or may not need surgical intervention. It must not be forgotten that perforation can occur in these cases. In three of Carter's cases the pain was due to appendicitis. If the condition is not one requiring surgical intervention then the ice-bag or stupes, or a light application of the cautery or small doses of bromides or codeine may be used; or, if more severe, small doses of morphine.

The **cerebral disturbances** are characteristic of this disease. In the early stages there may be much headache. This is best treated by the ice-cap. Sleeplessness is another common occurrence, and, as has been explained in considering rest, a symptom to be combated.

Hydrotherapy properly applied mitigates this to a great degree. Small doses of bromides may be used, or trional in 15 to 20 grain doses, or chloralamid in 20 to 30 grain doses; but if it is marked and prolonged, morphine is the best drug to use. Delirium and stupor are best met by the baths. In all decided cerebral symptoms, help may be obtained from the tepid bath, with cold water poured over the head; from the ice-bag, from morphine, and, finally, when the delirium is great or the stupor deep, from lumbar puncture, an easy and innocent procedure. Draw off 20 c.c. at least, and more will do no harm, though headache may be aggravated by draining the cord. No delirious patient should be left alone for a moment. Restraint by sheets or other devices are sometimes needed.

Circulation. When the characteristically slow pulse of typhoid fever becomes rapid, going above 100 to 110 to 120, our concern is elicited. If the circulation is weakening, we shall get a poorer quality of first sound of the heart, perhaps evidences of dilatation and mitral insufficiency, poorer quality of pulse, and a fall in blood pressure. A sufficiency of diet, fresh air and hydrotherapy do much to prevent this disaster. If, however, the condition supervenes, stimulants must be given.

As in other infectious diseases the vaso-motor apparatus is in the great majority of cases at fault rather than the myocardium and for this reason vaso-motor stimulants would seem logically to be indicated. In **cold water** as applied in the Brand bath we have such a stimulus and in **cold, dry, open air** another, but all our drugs, classed as vaso-motor stimulants are weak assistants, their effects, as a rule, not marked and their action short lived. Personally, I am much more impressed with the **digitalis series** even when the myocardium is not involved and much more when it is, and I prefer to give them in large quantities when the circulation falters. I give the infusion ℥ss (15 c.c.) three times a day or the tincture m. xxx (2 c.c.) three times a day for three or four days, or if the patient is under close observation longer, until either improvement in the symptoms occur, better quality of heart sounds, better pulse, improved blood pressure or evidences of accumulation in slower pulse or irregularity of pulse or vomiting or diarrhea ensue.

In urgent circulatory distress I begin with ½ to ¾ milligram (gr. 1/120 to gr. 1/90) of **strophanthin** into a vein or muscle and begin the digitalis at once.

If one hesitates about these doses m. x (0.66 c.c.) of the tincture or ʒi–ii (4–8 c.c.) of the infusion may be used three times a day, day in and day out, but pressing demands are not met by these small doses.

For those who take issue with my use of digitalis in these cases or if satisfactory results do not follow such usage, I recommend as vaso-motor stimulants a soluble salt of **caffeine,** either the double salt of caffeine and sodium salicylate in doses of gr. v (0.35 Gm) into the muscle every four, three or two hours or **camphor** in solution in oil (sesame or olive) 10 per cent. or 20 per cent. in doses of gr. v (0.66 c.c.) into the muscle at four, three, or two hour intervals; or the caffeine and camphor may be alternated at two hour intervals.

I have less faith in strychnine but it is recommended in doses of gr. 1/40–1/30 (1⅓–2 mg.) every three or four hours.

In threatened collapse **adrenalin** may be used in doses of m. xv (1 c.c.) into a muscle or m. iii–iv (0.20 c.c.) into a vein and followed up by caffeine, camphor and strophanthin.

Alcohol requires a special discussion. Briefly, I do not consider it a stimulant in the true sense of the word. Viewed from a chemical, pharmacological, or therapeutic standpoint, I think the weight of evidence is against its stimulating properties. It is hard to conceive that this member of the marsh-gas series, all of whose other members—alkanes, alcohols, aldehydes, ketones—are depressant, should furnish this one exception, ethyl alcohol; or two, ethyl alcohol and ethyl ether, which are stimulating. The results of animal experimentation are decided for the depressant effect of alcohol, while I am convinced that the trend of therapeutic opinion is increasingly in the same direction.

That the stimulating effect of alcohol on the mucous membrane of the stomach may reflexly stimulate the circulation is left sub judice; that alcohol has a food value is scarcely denied, and, no doubt, has contributed to the patient's strength when the food is insufficient;

but neither of these effects are justification for the use of alcohol as it has been administered in typhoid fever. In the so-called typhoid state, characterized by cerebral excitation, sleeplessness, rapid pulse, dry skin, coated tongue, and subsultus tendinum, the picture, to my mind, is one of hyperexcitation of the nervous centres by the toxins of the disease. I believe that the improvement seen in this condition by the judicious use of alcohol is due to the sedative effect of the drug on these centres and not to stimulation. This conception confines the use of alcohol to this stage or state of the infection and decries its use where any of the functions are failing from exhaustion. Personally, I would rather not use it at all in typhoid fever.

The urinary tract is not to be neglected. In the early days of the disease especially, the patient's bladder may be overdistended. Close observation should be directed to this organ, and with the first evidences of **retention,** efforts should be made, by hot applications over the hypogastrium or by hot enemas, to provoke urination. If such measures fail, catheterization must be done, but should be done by the physician, to avoid by his care the infection that so frequently follows this procedure. Overdistention means stagnation, weakening of motility, and lowered resistance to infection by pathogenic organisms and invites a bacilluria. **Bacilluria** is a very real menace, more to the community than to the patient himself, as true cystitis or pyelitis of typhoid origin is rare. It occurs in nearly 25 per cent. of the cases, often in such numbers as to render the urine turbid. It is most common as the temperature begins to approach the normal and runs into convalescence. It probably arises by infection through the kidney, the bacilli finding a good culture medium in the urine, especially when the urine is of a low acidity and there is any stagnation, such as might result from neglect of overdistention.

The bacilli tend to disappear spontaneously, probably at such a time as the urine becomes a less favorable medium and the improved tone of the bladder facilitates mechanical removal. However, the condition may remain for weeks, months and, in a few cases, for years. It has been shown that a high degree of acidity, and especially an increasing content of organic acid, inhibit their growth. The effort should be made to eliminate them, as a prophylactic measure, for absence of local symptoms make the convalescent an innocent menace to the community. **Urotropin** has been shown to have an astonishing effect on their growth, sometimes clearing up a turbid urine in a day or two. It may be given in doses of 5 to 15 grains for two or three days, a week, or continuously, beginning late in the disease and continuing into convalescence.

A good rule would be, beginning when the temperature approaches normal and continuing for a month after, to give 5 to 10 grains of urotropin three times a day for three consecutive days each week. When this does not clear up the bacilli, or a true **cystitis** prevails, bladder irrigations of silver nitrate, 1 to 5,000 daily, or a saturated solution of boric acid, should be instituted.

Perhaps the most promising field of specific therapy at this time is the **vaccine** treatment, the hypodermic use of the dead bodies of the bacilli, derived from the patient's own blood (autogenous) or from others (heterogenous).

These have been used to some extent and favorable reports have been made, some authors using only 1,000,000–2,000,000 at a dose at weekly intervals and others 100,000,000–500,000,000. No conclusions sufficiently definite can yet be drawn to justify the recommendation of this measure to the general practitioner.

Drugs aimed at the disease itself, intestinal antiseptics, etc., have been left out of consideration, because it is believed that, on the one hand, no good results are to be obtained, while, on the other, harm may be done by the drugs themselves and by the neglect of the more useful measures advised, entailed by reliance on the drugs.

Complications. Bulky monographs have been devoted to the complications of this disease in both medical and surgical fields. In general these complications are to be treated as they would be if primary or under other circumstances.

I will mention only the more common.

Phlebitis. To be treated by rest (fixation of the limb) and application of thick layers of non-absorbent cotton (a dry poultice) or wet dressings such as aluminum acetate or poultices frequently applied.

Conner believes thrombo-phlebitis to be more common than ordinarily accepted, in 10 per cent. to 15 per cent. of all cases and not always recognized. Obscure recurring chills, rises of temperature in convalescence, prolonged and irregular types of fever he believes to be due to such unrecognized phlebitis.

Tender toes is another of its manifestations and, more important, the pleural and pulmonary complications occurring late in the course.

TREATMENT OF CONVALESCENCE

After the temperature has been normal for a week or ten days, the patient may be propped up in bed, and in three or four days more be allowed to sit up in the chair, a little longer each day, and if all goes well, in a week he may be allowed to try his feet.

A slight rise in the temperature, day after day, is one of the most nagging features of a convalescence. This may be due to absorption from a neglected bowel, or it may be due to insufficient food, and eminent clinicians long ago pointed out that these patients' temperatures returned to normal when solid food was given them. Others still, who have been highly toxic, whose urea-forming function has been impaired, may become febrile if meat is given too early

—the so-called "febris carnis." Others mend rapidly when kept in the air and light.

Every case must be approached on its merits, and if the pulse shows by its rate and poor quality that the demands on it are too great, the rest must be prolonged and the getting up be more gradual. To get the patient out in the sun and air is certain to facilitate the progress of his convalescence. During this time his bowels must be attended to with the same care as during his illness in bed, at first aiding with enemas, and later with a mild cathartic like cascara. If there is a great deal of anemia, Blaud's pills may be given, 5 grains (0.30 Gm), three times daily. If the weakness is prolonged, strychnine, 1/40 grain (0.0015 Gm), three times daily, may be administered.

After the patient has been restored to a considerable degree of strength, he should still be forbidden to return to work too early. A long vacation, if possible of three to six months, should be taken in other surroundings.

Prophylaxis. Typhoid fever is a preventable disease. Its prevention awaits upon the overcoming of an inertia. McCrae divides the subject under three heads: (1) General measures, which are for the protection of the community; (2) special measures in connection with the patient; and (3) preventive inoculation. The knowledge that the disease is conveyed through the water, milk, food, especially oysters and green vegetables eaten raw, demand the supervision of the State and the community, through Boards of Health and Sanitary Commissions, supervision of the water supply with reference to policing the water sheds, filtration plants, and all the details dictated by sanitary science. It demands supervision of the milk supply, inspection of the dairies, health of the workers, and a consideration of sewage disposal with reference to oyster beds. It demands notification by physicians to Boards of Health of all cases of typhoid or suspected typhoid fever occurring in a community, and it demands education of the public through schools, lectures, and exhibitions of the part these various factors play in the prevention or spread of the disease.

In connection with the patient arises the question of isolation. Here in New York, as pretty much everywhere else in this country, typhoid fever is treated in the same wards as the general run of cases, and we assume from our familiarity with this condition of affairs that there is no danger in the practice. It is a little startling, then, to be told that the statistics of one of the best conducted hospitals in this country show that from 1.5 per cent. to 2 per cent. of the cases of typhoid fever treated in this hospital are of hospital origin. I have seen this thing occur in my own wards, and so has every attending physician, but still our patients are not isolated. As regards the disinfection of stools, urine, sputum, vomitus, and care of clothing and utensils, all this has been touched upon. If we were faithful in carrying out these measures in every case of typhoid fever, there soon would be no more cases, for, after all, the patient is the true source of typhoid fever.

The attendants about a patient are sources of infection for others unless conscientious in their cleanliness. A great source of danger that might be overlooked are the flies, carrying the infectious material direct on their legs and bodies from the excreta to food and water. Screens are an obvious help in their exclusion.

One great menace to the community, the handling of which is no easy problem, is the chronic bacillus carrier. Some patients harbor for months and years virulent bacilli in the urine, and more commonly in the feces, from constant passage into the bowel of bacilli from an infected gall-bladder. Bacilluria and its treatment have been touched upon. Some day, perhaps, Boards of Health will demand to know whether the stools of a typhoid fever patient are free from bacilli before he is allowed the freedom of the community, as they now demand to know whether the Klebs-Lœffler organism is absent from the secretions of diphtheria patients before release from quarantine.

Carriers. The use of vaccines for the purpose of ridding "carriers" of their infection seems at the present moment to hold out the most promise. Cases of cure have been reported in urinary "carriers," feces "carriers," and old bone lesions.

The urinary cases have succeeded when hexamethylendiamin (urotropin) failed. The doses ranged from 25,000,000 (beginning) up to 1,000,000,000 in six to nine doses at four days to one and two week intervals.

One feces "carrier" was reported cured by the use of bacillus Bulgaricus.

One gall-bladder "carrier" was reported cured after repeated exposures of gall-bladder to the X-ray. In some of the gall-bladder "carriers" only drainage of the gall-bladder seemed successful.

It must be remembered as a check upon enthusiasm for any one measure that some of the "carriers" discharge bacilli only intermittently and repeated examinations at not too short intervals must be made before certainty of a case is assured.

Preventive Inoculation. As has been said, serotherapy has not yielded tangible results as yet, but great results have followed the preventive inoculation or vaccination originated and applied to the troops of the British army by Sir A. E. Wright.

His procedure consisted in the culture in bouillon of the organism for four weeks, then killing at 60° F. Different strains were mixed together, standardized, and two injections made at intervals of two weeks of amounts of 0.5 to 1.5 c.c., the first containing about 1,000,000,000 bacilli, the second 2,000,000,000.

This was usually injected into the flank, from which might result some redness and pain and involvement of lymph glands draining that territory. There was some constitutional reaction, fever, malaise, nausea and vomiting, but of no significance.

Statistics seem to show that among some 20,000 inoculated soldiers the incidence of disease and the mortality was about one-half of that of the 150,000 uninoculated.

With certain improvements in technique made by Leishman of the British Army and by our own Army Medical Service under Major Russell, antityphoid inoculation has become the most fruitful and certain preventive treatment since Jenner's introduction of vaccination against small-pox. Compulsory inoculation in our army and navy has fortunately afforded a most convincing body of statistics. Bodies of workers and individuals have been quick to seize the advantage of such a measure, and it is safe to predict that communities will protect themselves by compulsory inoculation.

Statistics are easily available for those who are open minded.

I will only cite the published figures that contrast the condition in two great Military Camps, one at Jacksonville on the occasion of the Spanish-American War in 1898 and the other the recent camp at San Antonio along the Mexican border.

Jacksonville, troops, 10,759. Cases of typhoid, 2,693. Deaths, 248.

San Antonio, troops, 12,801. Cases of typhoid, 2. Deaths, 0.

What a triumph of Modern Medicine these figures bespeak!

Reliable vaccine is now supplied by various Health Boards and by well known drug firms.

It is usual to inoculate in three doses at ten day intervals (they may be shortened to a week) the first dose being 500,000,000, the second and third each 1,000,000,000.

Reaction may occur in a minority of cases, usually mild, rarely severe. These reactions may be local or general.

The local induces a redness and heat about the site of the injection. It rarely needs attention, but if discomforting a simple wet dressing may be applied.

The general reaction is that of any slight infection; a mild "grippe" attack: Major Russell with his vast experience can unqualifiedly pronounce the procedure harmless.

The duration of immunity is placed by Russell at "assuredly" two and a half years and probably longer.

This does not mean that the recognized immune bodies last that long and Russell calls attention to the fact that in cases of recovery from typhoid, though immunity usually lasts for life, "the immune bodies, nevertheless, disappear from the blood of convalescents within a few months." Russell has further called attention to the fact that about one-third of deaths from Typhoid occur under twenty years; hence accentuates the necessity for inoculation of children.

Some observers have called attention to the onset of tuberculosis and other infections after inoculation, but the statistics are not convincing to me as being anything more than coincidence or the normal incidence of the disease in question.

To individuals going out of their usual environment to an unknown water and food supply, antityphoid inoculation is a wise procedure.

SUMMARY

- Rest.
- Bed—how made. (See text.)
- Preparation for the open air. (See Pneumonia, Chap. IV.)

Room—Choice. (See text.)

- Screens against flies.

Care of the body.

- Mouth.
  - Washes and sprays of boric acid solution, 2 per cent., 4 per cent., or ½ strength Dobell's solution.
- Teeth.
  - Brush two or three times a day; cleanse interstices, cotton on wooden tooth pick applicators saturated with boric acid or Dobell's solution.
- Tongue.
  - Soften coat with ½–¼ strength peroxide of hydrogen solution, scrape with edge of a whalebone.
- Pharynx.
  - Remove mucus with cotton swabs on applicators.
- Sordes and fissures.
  - Soften sordes with ½–¼ strength of peroxide of hydrogen solution; then cleanse with the boric acid or Dobell's solution.
- Use mild antiseptic, e.g.,

℞

Phenol solution	1–20		
Glycerin		āā ℥i	30 c.c.
Boric acid, saturated solution, ...		℥viii	240 c.c.

M. et S. To be used as a mouth wash.

- Sucking bits of cracked ice.
- Nose.
  - Soften dried secretions with sweet oil on cotton on applicator.
  - Cleanse with boric acid or Dobell's solution in sprays or on swabs.
- Skin.
  - Cleansing bath daily, castile soap and water.

- Use drying powder, talcum.
- Sponge buttocks with equal parts of alcohol and water.
- If buttocks are much soiled, cleanse with phenol solution, 1 to 40.

Bed sores.

- Prevention. Clean skin, dry skin, frequent change of position, rubbing of parts most pressed upon to improve the circulation.
- Smooth bed clothes, mattress and sheets.

Threatening.

- Use of rings.

Developed.

- Use rings.
- Use water bed or air bed.
- Use drying powder on excoriations, e.g., aristol, or
- Use ointment such as zinc oxide ointment.

Serious sores.

- Surgery.

Disinfection.

Stools.

- One to 20 phenol (carbolic acid). Use twice the bulk of the stool, break up the stool, allow it to stand in the solution for several hours.
- Chlorinated lime (must be fresh) 1 per cent. solution or a handful in a bed-pan with enough water to cover stool. Let it stand several hours.

Urine.

- One to 20 phenol, using 1/3 to equal amounts with urine.
- Let stand two or more hours.
- One to 1,000 bichloride in volume equal to 1/15–1/40 of the urine. Let stand two or more hours.

Bath water.

- Half pound of chlorinated lime to one tub (200 litres). Stand an hour.

Bed linen.

- One to 20 phenol—soak two hours, or formalin 3 ounces to 1 gallon (100 c.c. to 4 litres), soak twelve hours, boil thoroughly.

Bed-pans, urinals, rectal tubes, rubber sheets, 1 to 20 phenol; allow to stand in it.

Knives, forks, spoons, crockery. Boil.

Sputum. Burn.

Vomitus.

- One to 20 phenol.
- 1 per cent. chlorinated lime.

Precautions for physicians and nurses.

Wear rubber gloves and aprons in giving baths, and wash hands later with soap and water and with 1 to 1,000 bichloride of mercury.

End of illness.

- Mattresses.
- Dry heat—(not practical at home).

Room.
  Formaldehyde gas.

Diet.

Aim at 3,000 calories (40 calories per kilo) in early weeks and more in latter weeks, as much more as the patient wishes or will take and handle well.

Proteid—70 to 90 grams.

Carbohydrates the mainstay (the proteid shelterer).

Fats fairly liberally.

Frequency of feeding.

Every two hours. Some patients will do better at longer intervals. It is better not to disturb the patient's night's rest for feeding.

Milk, the basis of the dietary—1 to 2 quarts a day.

Caloric value—640 to the quart, one glass of 8 ounces equals 160 calories.

Milk enriched by cream and milk sugar.

Cream—16 per cent. gravity, 50 calories per ounce.

Lactose—120 calories per ounce.

One glass containing	milk,	7 ounces,	140 calories.
“ “ “	cream,	1 ounce,	50 calories.
“ “ “	lactose,	½ ounce,	60 calories.
		Equals	250 calories.

One glass containing	milk,	6 ounces,	equals	120 calories.
“ “ “	cream,	2 ounces,	equals	100 calories.
“ “ “	lactose,	½ ounce,	equals	60 calories.
			Equals	280 calories.

One glass containing	milk,	6 ounces,	equals	120 calories.
“ “ “	cream,	2 ounces,	equals	100 calories.
“ “ “	lactose,	1 ounce,	equals	120 calories.
			Equals	340 calories.

Eggs may be given up to 4, 5, or 6 a day.
  One egg equals 80 calories.
  One egg white equals 30 calories.
  One egg yolk equals 50 calories.
  May be given soft boiled, coddled, or raw, or in soft or baked custard, or eggnog.

Bread, white, home made, equals 1,225 calories to 1 pound.
  One slice, 1¼ ounces, equals 100 calories.
  Given as toast, milk toast, bread and butter, bread and milk.

Butter equals 3,600 calories to 1 pound.
  One pat of butter (⅖ ounce) equals 100 calories.

Put on bread and cereals.

Cereals—vary somewhat, but one helping of two heaping tablespoonfuls equal about	100 calories.
Rice—one heaping tablespoonful equals	100 calories.
Potato—baked (medium) equals	100 calories.
Potato—mashed, 1½ tablespoonfuls,	100 calories.

Table.

Milk—one glass, 8 ounces,	160 calories.
Cream—one ounce,	50 calories.
Sugar—one ounce,	120 calories.
Egg—one,	80 calories.
Bread, one slice, 1¼ ounces,	100 calories.
Butter, one pat, ⅖ ounce,	100 calories.
Cereals, two heaping tablespoonfuls,	100 calories.
Rice, one heaping tablespoonful,	100 calories.
Potato, baked, one,	100 calories.
Potato, mashed, 1½ tablespoonfuls,	100 calories.
Crackers, Boston, one,	42 calories.
Oysters, ten,	48 calories.
Pilot bread, one,	131 calories.
Soda, Educators, one,	10 calories.
Uneeda biscuits, one,	25 calories.
Ice-cream (average) 2 heaping tablespoonsful,	200 calories.
Baked custard, 2 heaping tablespoonsful,	180 calories.
Soft custard, 4 heaping tablespoonsful,	130 calories.
Bread pudding, 2 heaping tablespoonsful,	225 calories.
Koumys, one glass, 7 ounces,	100 calories.
Buttermilk, one glass,	80 calories.
Whey, one glass,	50 calories.
Apple sauce, one ounce,	50 calories.
Macaroni, 2 heaping tablespoonfuls,	100 calories.

Among other articles may be mentioned tea, coffee, cocoa to carry sugar and cream, lemonade, orangeade, wine jelly to carry sugar.

Chicken, veal or mutton broth to stimulate an appetite, thickened with rice, barley, arrowroot to add calories.

Potato, pea and tomato soup, junkets.

Sample diet modelled on Coleman list, avoiding night feeding.

Milk,	7 ounces,	equals 250 calories, at 5 a.m.	250.
Cream	1 ounce,		
Lactose,	½ ounce,		

Egg, one,	80 calories.	at 7 a. m.	
Toast, two thin slices,	100 calories.		
Butter, 1½ pats,	150 calories.		
Coffee with cream, 2 ounces,	100 calories.		
Lactose, ⅔ ounce,	80 calories.		
	510 calories.		510.
Milk as above,		at 9 a. m.	250.

Egg, one,	80 calories.	at 11 a. m.	
Mashed potato, ½ tablespoonful,	30 calories.		
Baked custard, 2 heaping tablespoons,	180 calories.		
Toast or bread, two small slices,	100 calories.		
Butter, 1½ pats,	150 calories.		
Coffee, cream, 2 ounces,	100 calories.		
Lactose, ⅔ ounce,	80 calories.		
	720 calories.		720.
Milk as above,		at 1 p. m.	250.
Milk as above,		at 3 p. m.	250.
Egg, one,	80 calories.	at 5 p. m.	
Cereal, 3 tablespoonfuls,	150 calories.		
Cream, 2 ounces,	100 calories.		
Sugar (powdered), 1 heaping teaspoonful,	50 calories.		
Applesauce, 1 ounce,	50 calories.		
Tea, cream, 2 ounces,	100 calories.		
Lactose, ⅔ ounce,	80 calories.		
	610 calories.		610.
Milk as above,		at 7 p. m.	250.
Milk as above,		at 10 p. m.	250.
			Total 3,340.

Drinks.

Water ad libitum; offer hourly when patient does not ask for it, or alkaline waters, lemonade and orangeade and Imperial drink, to which the addition of sugar increases the caloric intake.

Two to three quarts of fluid daily and more if patient will take it.

Avoid slavish adherence to exact dietaries.

Vary the food to avoid monotony.

Increase calories in decline of fever.

Add chicken, fish, meat, and vegetables in convalescence; begin with chicken or scraped beef, where temperature is normal or nearly so, and add other articles gradually and tentatively,[1] such as chops, spinach, asparagus tops, peas, and stringed beans put through a purée sieve.

Hydrotherapy.

Brand bath. (For technique, see text.)
Ziemssen's graduated bath. (See text.)
Slush. (See text.)
Packs.
Sponges.

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[1] For caloric values of foodstuffs consult tables of Attwater and his co-workers, issued by U. S. Department of Agriculture.
Food Values by Edwin Locke.
Tables of Prof. Irving Fisher in *J. A. M. A.* April 20, 1907.
Tables of Arnold in *J. A. M. A.* December 24, 1910.
Coleman in Articles referred to.

Care of Alimentary Canal.

When first seen early.

- Castor oil (Oleum ricini), ℥ ¾ to 1 (20–30 c.c.).
- Epsom salts (Magnesium sulphate), ℥ ¾ to 1 (20–30 Gm).
- Rochelle salts (Sod. et Pot. tartrate) ℥ ¾ to 1 (20–30 Gm).

or

Calomel (Hydrargyrum chloridi mitis), gr. ¼ (0.015 Gm) every quarter hour for 6 doses and followed by one of the above.

Later and if seen late.

- Enemata of tepid water.
- Soapsuds—use castile soap.

Oil enema.

Make thick suds with castile soap and warm water, stir in oil slowly, then add water to 1 or 2 pints.

Tympanites.

- Suspect milk sugar, cut it down or eliminate it.
- Rectal tube.
- Stupes. (See text.)
- Turpentine.
  - In stupes.
  - In enemata.
  - By mouth.
  - In Capsule or Emulsion. m. x.

  (See text.)
- Ice bag.
- Ice coil.

Diarrhœa.

- Suspect fat.
- Cut down or eliminate.
- Boiling milk may help.
- May have to stop milk.
- Saline irrigation, sodium chloride ʒi (4 Gm) to 1 pint (500 c.c.), prolonged.
- Murphy drip.
- Astringents.
  - Bismuth subnitrate, gr. xxx (2 Gm) every three or every two hours.
  - Opium if imperative, pill, gr. ½ (0.030) every two hours for 2, 3 or 4 doses.

℞

Pulv. opii	0.25	(gr. iii ¾)
Pulv. camphoræ	1.00	(gr. xv)
Plumbi acetatis	3.00	(gr. xlv)
Bismuth subnitratis	30.00	(℥i)

M. et Div. in chartulas no. xv.
S. One every 4 hours.

Gastric distress.

Suspect both fat and lactose. Cut down or eliminate.

Vomiting.

Cracked ice, sucked.

Mustard paste to epigastrium (1 in 4).

Bismuth subnitrate	gr. xv–xxx (1–2 Gm)
Sodium bicarbonate	gr. x–xx (0.66–1.33 Gm)
Cerium oxalate	gr. iii–v (0.20–0.30) Gm)
or combine	

℞

Bismuthi subnitratis	15 (℥ss)
Sodii bicarbonatis	10 (ʒiiss)
Cerii oxalatis	5 (ʒi ¼)

M. et Div. in chart No. xv.
S. One every two hours (in the food if given).

- If very severe.
  - Cocaine hydrochlorate—tablet gr. ⅕ (0.010 Gm), or ⅒ per cent. solution ʒi (4 c.c.) every two hours.
- Stomach washing, lavage.

Hemorrhage.

- Early stages, oozing, no treatment.
- Serious latter part of second and third week.
- Mild.
  - Cut down food.
  - Enjoin rest.
- Moderately severe.
  - Ice bag to abdomen.
  - Calcium lactate, gr. x (0.60 Gm) three times a day.
  - Horse serum 10–20 c.c.
  - Human serum 10–20 c.c.
- To avoid anaphylaxis in use of serum. (See text.)
- Severe with symptoms of hemorrhage. (See text.)
- Morphine hypodermically or intramuscularly, gr. ¼ (0.015 Gm).
- Exsanguination.
  - Elevate foot of bed.
  - Heat to extremities.
  - Physiological salt solution (ʒi–Oi) (4 Gm–500 c.c.) hot in the bowel.
  - Hypodermoclysis of same, or Ringer's solution.
  - Infusion of same into vein.
  - Best of all, transfusion. (See text.)
- Perforation. For symptoms see text.
  - Surgical intervention.

Nervous system.

- Headache.
  - Ice bag.
- Sleeplessness.
  - Less marked with the Brand bath and sufficient diet.
- Bromides.
  - Bromide of potash, gr. xv–xxx (1–2 Gm).
  - or

℞

Potassii bromidi.
Ammonii bromidi.
Sodii bromidi ....āā 5.00 (gr. lxxx)
Aquæ destillatæ ....q.s. ad. 60.00 (℥ii)
M. et S. ʒi in water. Repeat in two hours if needed.

- Trional—gr. xv–xx (1–1.30 Gm). In a little warm water or in whisky, brandy or wine or in powder; wash down with water. Repeat in two hours if needed.
- Chloralamid—gr. xx–xxx (1.30–2 Gm).
  - In cold water (not hot), in wine, whisky or brandy, or in powder and wash down with water.
  - Repeat if needed in two or three hours.
  - If marked or prolonged.
    - Morphine, gr. 1/16–1/4 (0.005–0.015 Gm).

Delirium—Restraint.

- Cold baths.
- Tepid baths with cold water to head.
- Ice bag to head.
- Morphine hypodermically gr. 1/8–1/4 (0.008–0.015 Gm).

Lumbar Puncture.

- Draw off 20 or even more c.c.
- For technique see cerebro-spinal meningitis, Chap. XVII.

Stupor.

- Cold baths.
- Tepid baths.
- Ice bag to head.
- Lumbar puncture.

Circulatory disturbances.

- For symptoms see text.
- Prevention.
  - Sufficient diet.
  - Cold baths.
  - Fresh air.
- Failing circulation.
  - Digitalis.
  - Infusion ℥ss (15 c.c.) three times a day,
  - or tincture m. xxx (2 c.c.) three times a day for three or four days,
  - or longer until improvement in the circulation is seen or accumulation is evidenced. (See text.)
- In urgent circulatory distress.
  - Strophanthin (Boehringer's) (0.0005–0.00075 Gm) (gr. 1/120–1/90) intramuscularly or intravenously, and then follow with digitalis as above.
- When either therapeutic or toxic effect is severe, stop using for three or more days, and repeat if needed.
- Another method (less satisfactory).

Digitalis infusion ʒi–ii or tincture m. x three times a day may be given without interruption unless the stomach is irritated.

If satisfactory results do not ensue, or for any reason (idiosyncrasy) digitalis can not be taken,

Vaso-motor stimulants.

Caffeine sodium salicylate or caffeine sodium benzoate, gr. v (0.35 Gm) into muscle every four, three or two hours.

Camphor in oil 10 per cent. or 20 per cent., gr. v (0.35 Gm) every four, three or two hours, or alternate at every two hour intervals the caffeine and the camphor in gr. v (0.35 Gm) doses.

Strychnine (less valuable), gr. $\frac{1}{60}$–$\frac{1}{30}$ (1–2 mg.) every three or four hours. Given hypodermically.

Threatened collapse.

Adrenalin (Epniphrin) m. xv (1 c.c.), into a muscle or m. iii–iv (0.20 c.c.) into a vein. Follow by caffeine or camphor in gr. v (0.35 Gm) doses into muscle and by strophanthin ½ mg. (gr. $\frac{1}{120}$) into muscle or vein.

Urinary tract.

Bacilluria.

Urotropin as a routine.

Begin as temperature approaches normal and continue for a month after, gr. v–x (0.30–0.60 Gm) three times a day for three consecutive days each week.

If urine is alkaline, add benzoate of sodium or ammonium, gr. x (0.60 Gm) to each dose of urotropin.

If this does not clear it up use
Bladder injections of silver nitrate 1–5,000 solution daily,
or saturated boric acid solution daily.

Specific treatment.

Still too experimental to recommend to the general practitioner.

Complications.

Phlebitis.

Rest—fixation relative or absolute.
Enclose in non-absorbent cotton.
Wet dressings—Aluminium acetate.
Poultices. (See Pneumonia, Chap IV.)

Convalescence.

See diet in summary.
After temperature is normal, seven—ten days,
Prop up in bed: three to four days more,
Sit up in chair, a little longer each day, until after a week;
Get on feet.
If temperature rises, consider bowels; too much meat too early.
Get out in sun and air.
Watch bowels.
Mild cathartics such as cascara, aloin.

Treat anæmia.

Blaud's pill (Pil. ferri carb.) gr. v (0.35 Gm) three times a day.

For weakness.

Strychnine sulphate, gr. $\frac{1}{60}$–$\frac{1}{30}$ (1–2 mg.) three times a day, or

Tincture nux vomica m. x–xv (0.60–1 c.c.) three times a day.

Do not return to work, or admit business matters too soon.

Long vacation of three to six months.

Prophylaxis.

Boards of Health and Sanitary Commissioners.	Protection of community. Supervision of water supply. Filtration plants. Policing water sheds. Supervision of milk supply; inspection of health of workers. Inspection of drains. Inspection of oyster beds. Inspection of green vegetables. Sewage disposal. Notification of cases. Education. Lectures. Schools. Exhibitions.

The patient.

Isolation.

Disinfection of all discharges and clothes and utensils. (See above.)

Preventing access of flies by screens.

Care on part of attendants.

Treatment of "carriers."

Prophylactic; urotropin as above.

Inspection of urine and stools of convalescents for the organisms.

Vaccines for all "carriers," beginning 25,000,000, work up to 1,000,000,000, four to seven day intervals, in six to nine doses.

May try for feces "carriers."

Bacillus Bulgaricus by mouth; or by rectum in small amount of sugar solution, 2 per cent.

Gall-bladder "carriers."

X-ray cure has been reported.

Drainage of gall-bladder has been necessary and has cured.

Preventive inoculation, vaccines.

	1st dose.	500,000,000.
After 7 to 10 days.	2nd dose.	1,000,000,000.
After 7 to 10 days.	3rd dose.	1,000,000,000.

CHAPTER VI

MALARIA

From the barks of the various species of cinchona is derived an alkaloid, called quinine, and this quinine is more truly a specific than any other drug in the whole pharmacopeia.

The treatment of malaria resolves itself pretty much into the skilful use of quinine.

The rôle of the mosquito, the anopheles, the varieties of the lowly order of animal life, the sporozoan protozoa (the plasmodium vivax, or tertian parasite, the plasmodium malariæ or quartan parasite and the plasmodium falciparum or estivo-autumnal or malignant parasite), the stereotyped manifestations of chill, fever and sweat and the intermittent or remittent temperature in malarial infection are familiar to us all.

It is only within the last three or four years that, thanks to the labors of Bass, the cultivation of the malarial organisms has become possible and undoubtedly much light of therapeutical value will be shed on the problem by him and those who are using his methods.

While we are interested in the differentiation of the manifestations of the disease, into the tertian, quartan or estivo-autumnal forms, as based on the variety of the invading organism, the degrees of severity, after all, depend not a little on where the infection occurs as well as on what organism is present. In the Northern States we have to treat relatively mild cases; in the South much more severe and some pernicious types; and in the tropics many pernicious cases.

Considering first the milder cases as seen here in the North, some of them are so slight that the patient may object to going to bed. The ordinary attack, however, compels the patient to seek rest.

In any case our results are better when the patient does go to bed and is made to observe rest.

Rest. The difference between the appearance of the shaking, fevered or sweating patient of one day and the apparently well individual of the next, is one of the most striking contrasts of medicine.

During the period of intermission, the patient feels so well that he will often rebel against remaining in bed and greets his physician sitting up and dressed on the occasion of his next visit.

In the milder cases, no strenuous objection to this performance need be voiced; but, if the paroxysm has been severe, the patient should be assured that his remaining at rest facilitates success in aborting the second. In the remittent estivo-autumnal forms it should, of course, be insisted upon. Each individual paroxysm means an intoxication, and as the result of this and the marked pyrexia accompanying it, tissue destruction has been entailed which makes all the more imperative the economy in the body's energies accomplished by rest of the tissues attacked by the organism. The one tissue in which a gross lesion occurs, is the red blood-cell and its destruction induces a degree of anemia. Now, in untreated cases or badly treated cases, emaciation and anemia of a marked grade ensue and the necessity for rest is as urgent as in other infections of long continuance. With prompt treatment this does not obtain, and after an anticipated paroxysm fails to appear the patient may be allowed to get up.

Bed. On account of the brevity of the attack, when well treated, one may be less insistent on the nicety of details with reference to the bed than in the infectious diseases of longer continuance, if it entails extra expense in the procuring; but in severe cases, in pernicious types with continued fever, we economize the strength both of the patient and attendant and enhance the success of our treatment if an iron half-bed with woven wire-springs and firm mattress, which is best illustrated by the hospital bed, is used.

Room. If the patient is still in a malarious district his room should be so chosen that the chances of further infection are lessened. By selecting one in the upper part of the house, since the invasion by the mosquito is less likely, and making doubly sure by the use of screens or mosquito netting, this object is accomplished. This, too, affords a certain protection to attendants.

In other respects the room should be chosen in severe cases according to the same criteria that obtain in other acute infections, with a view to size, ventilation, light, access to the open air by veranda and nearness of bath-room, simplicity of furnishings and remoteness from disturbing elements of the household.

Diet. The suddenness of the attack, the anorexia, nausea and vomiting contraindicate any effort at nourishment during the paroxysm. During the afebrile periods of the intermittent type of fever, semi-solid or solid food of a simple character may be taken, but at any meal occurring within six hours of the anticipated recurrence of the paroxysm the food should be fluid or semi-solid, as milk, eggs, cereals or toast. This is in consequence of the vomiting that may ensue.

It is interesting to note that Bass and Johns in their studies on the culture of the plasmodium observed that the blood seemed to form a better culture medium immediately after a full meal and this they say corresponds with the clinical fact that the parasites will often disappear from the blood and the paroxysms cease if the patient is put to bed and given a purgative and put on a light diet.

If the fever is of the remittent type, the same precautions should be observed at the periods of paroxysm, but in the intervals the diet, while it should be somewhat restricted in the choice of food, should nevertheless contain sufficient nutritive value in terms of calories and proteid; some 2,500 to 3,000 calories and 70 to 100 grams of proteid.

Care of the Bowels. Calomel should be given either in one dose of gr. iii–v (0.20–0.33 Gm) or in divided doses of gr. ¼ (0.015 Gm) every ¼ hour for six or eight doses, and this may be followed in 3 to 4 hours by a saline. The best time to give the cathartic is between the paroxysms as the stomach is not likely to retain it during the paroxysm. It should, however, precede the quinine when possible.

SYMPTOMATIC TREATMENT DURING THE PAROXYSM

The phenomena of the paroxysm, chill, fever, and sweating have been looked upon as the expression of the action of a toxin released by the plasmodia at the time of sporulation, but Wade Brown from his recent studies concludes that they are all in part at least due to the toxic action of the malarial pigment, that is, hematin, derived from the destroyed red blood cells. The three stages of the paroxysm are each provided with their own particular form of discomfort for the patient and demand pretty constant attention and ministration to mitigate their evils.

Chill. Beginning with chilly sensations, followed by shiverings and then shakings, with the skin covered with "goose-flesh," pale, cyanotic, the face pinched and the teeth chattering, the patient can only complain of the cold and beg for **warmth.**

One does everything possible to afford this, by putting **hot-water bottles** to the feet, wrapping flannel about the extremities, heaping on blanket after blanket and giving **hot drinks, hot water, weak tea, hot weak milk,** into which a dash of ginger may be stirred, hot lemonade, a little hot whisky or brandy.

Vomiting. One other feature of this stage often requires interference—namely, vomiting.

If there is much useless retching, a **draught of warm water** may help to effect an evacuation of the stomach; then simple measures to stop further vomiting may be pursued, as sipping of **effervescent drinks** or putting a **mustard paste on the epigastrium.**

If the retching cannot otherwise be overcome, administer **morphine** hypodermically, in doses of gr. 1/12 or gr. ⅛ (0.005–0.008 Gm).

Collapse. In the old and feeble, symptoms of collapse may threaten during the chill. These are to be met by **hot drinks** of coffee, brandy or whisky, or a teaspoonful of aromatic spirits of

ammonia in water; or a little strong water of ammonia may be inhaled from a towel or handkerchief held a little way from the nose.

This stage lasts from a quarter of an hour in light cases to two hours in very severe ones; and then come occasional flushings of heat and gradually there is established the febrile stage.

Fever. In a few minutes the patient is "burning up with fever," complaining as bitterly of the heat as he was of the cold shortly before. The face is flushed, the whole skin red, the pulse bounding.

The hot-water bottles are removed, blanket after blanket comes off, until only a sheet remains; bits of **cracked ice** are sucked, **cold water** or **cold lemonade** is sipped, **cool sponge baths** given or sponges of water containing alcohol. A light rub with the hand, using 25 per cent. alcohol in water, affords much comfort.

Headache is the feature of this stage as vomiting is that of the chill, though occurring also in the first stage. This is relieved by **cold cloths,** wrung out of ice-water and applied to the brow. The cold sponging mentioned lessens the intensity of the headache. If, however, it is intense and not lessened by the measures advised and, especially, if delirium accompanies it, **morphine** in small doses hypodermically, gr. $\frac{1}{24}$ to gr. $\frac{1}{12}$ (0.003–0.005 Gm) may be given. Coal-tars should not be used.

This stage lasts usually from four to six hours and then as the fever declines, perspiration appears on the face and forehead and the third stage of **sweating** is ushered in.

Soon the whole body is covered with a drenching sweat and, except for the discomfort of the sweating, the patient grows rapidly better. Relief is afforded the patient in this stage by rubbing the body with dry towels and changing the linen. He may be allowed drinks of water or lemonade freely.

If symptoms of collapse intervene, as but rarely occurs, hot drinks and stimulation as advised during the cold stage should be given. Sleep usually follows this stage.

Such are the events and their treatment in the milder cases of tertian and quartan fevers of this latitude.

Of the estivo-autumnal fevers of the North, it may be said that they are more severe than the other types, but very rarely pernicious. The nervous symptoms and the aching pains of the limbs and back are more striking and the paroxysm is much longer, usually over twenty-four hours and often permitting but a few hours of intermission or remission.

Specific Treatment. As I have said **quinine** is looked upon as more truly a specific than any other drug in use, and yet its specificity is due to effects not confined to the plasmodium malariæ alone, but common to all protoplasm.

In general it is a protoplasmic poison. At first and in slight doses, this action on protoplasm is expressed by an enhancement of function, that is, stimulation; but this in turn, in sufficient dosage, is followed by depression of function, paralysis of same and death. That this action varies in degree in different stages of cell-growth and cell-activity is also true and upon this fact depends its usefulness as a drug.

Now, the protoplasm of the malarial organism seems peculiarly susceptible to it, but by no means equally so at all stages of its development. It is so much more susceptible to quinine than the body-cells, that amounts that will kill the plasmodium have no deleterious effects on the latter.

It is during the stage when development and nutrition are most active, that is, in the young stage of the parasite, that quinine is most operative. This fact has a practical bearing on the administration of the drug.

Bass and Johns believe that the quinine does not directly kill the parasites but produces a permeability of the red blood cells to the blood serum which contains an element destructive to the plasmodium.

Time of Administration. Many rules are given by numbers of physicians with reference to the time of administration, and by some of them with an insistence on exactness that would seem to attribute more of the success to this item in technique than to the drug itself. Facts about the absorption and excretion of quinine are as follows: Within thirty minutes evidences of it are found in the urine. In six hours half of it is eliminated, but after that the elimination is more tardy and traces of it can still be found in the urine after seventy-two hours.

Sporulation—the setting free of the young parasites in the blood-stream—occurs at the time of the chill. We should theoretically get the best results by a large dose given three or four hours before the anticipated chill, at a time when the maximum amount of quinine would be in the circulation to act upon the organisms during their egress from the red blood-cells. We may, then, a few hours before the paroxysm give our maximum dose. It goes without saying that this will in no way abort the coming chill, as the organisms responsible for that are protected in the red blood-cells; but it will destroy their offspring and abort the chill for which they would be responsible forty-eight or seventy-two hours later.

Again, as others advise, the quinine may be administered during the decline of the fever. The fever we believe to be coincident with the setting free of the parasite in the blood. The young organisms very quickly attach themselves to the red cells which they seek to penetrate.

If quinine is given at this time, its rapid absorption, as just expressed, brings it into contact with them and effects their destruction.

Still others advise dividing the daily dose, administering a portion, three times a day, every four hours or every six hours. As we have seen, only half the dose ingested is excreted in six hours, so this procedure keeps the blood cinchonized continuously. This method has advantages where the time of the paroxysm is more difficult to determine, as in the remittent or continuous forms, in quotidian infection and in the pernicious types, and particularly if there is a constant migration of plasmodia from cell to cell, as Mary Rowley Lawson contends.

So one may administer the dose (1) a few hours before an expected paroxysm; (2) at the decline of the fever of a paroxysm; or (3) divide the dose throughout the twenty-four hours.

The object is to have enough quinine in the blood to kill the organism when it is free.

Preparations. There are numerous salts of this alkaloid, representing varying weights of the alkaloid and varying solubility. Most of the salts are sparingly soluble; a few freely. Of these the **sulphate** (basic) which contains about 75 per cent. of the alkaloid (74.31 per cent.) is the one most commonly used when the drug is administered by the mouth. The more soluble acid hydrochlorate, or bisulphate, or bimuriate of quinine and urea is used for hypodermic purposes.

The sulphate is practically insoluble in water (1 in 800), and is usually administered in capsules or wafers. Pills and tablets are likely to be hard or tough and in this way the drug escapes absorption. The 2 grain (0.15 Gm) quinine capsule is the favorite unit. There is no question that this drug were better given in solution and, indeed, where the condition of the stomach leads to a suspicion of its impairment and hydrochloric acid may not be secreted, the solution should be used. The drug is freely soluble in any dilute acid, hydrochloric, sulphuric, phosphoric or tartaric. A minim per grain is enough. The objection to this method is the intensely bitter taste. Effort may be made to disguise it. One way is to dissolve the dose in a few grains of citric acid gr. x (0.60 Gm) in a little lemon juice, add to it water in which a pinch of bicarbonate of soda has been dissolved and take while effervescing.

The **bisulphate,** soluble in 8½ parts of water and the **bihydrochlorate** soluble in equal parts of water (1 to 1), may be used instead of the sulphate.

Dosage. I am convinced that our dosage for malaria in temperate zones has been too low and accounts for the frequent relapses.

Regardless of the form of infection I advise gr. xxx (2 Gm) of quinine a day until the paroxysms cease and at least gr. xx (1.30 Gm) a day for ten days to two weeks, and then gr. xv (1 Gm) on two successive days of each week for two months after. This amount may be divided into two or three doses a day.

I believe Wellman is right when he advises a repetition of the treatment thirty or forty days after the initial dose. If a case relapses it means either that the drug was not absorbed or the dose was insufficient. It is better with such a relapsing case to use the drug in solution.

Quinine in Children. Children require large doses proportionately; Wellman gives one grain for each year of a child's age three times a day. This rule to be followed to ten years.

Holt believes in much larger doses. He gives an infant of one year 8 to 12 grains, and says children of five to ten years require nearly as much as an adult.

I should favor the large doses. They can be given to infants and small children suspended in syrup of Yerba Santa, as Tannate, in chocolate lozenges and by rectum in solution or in starch paste. Use two or three times the dose by the mouth.

Pernicious Infections. As I have said, the pernicious type of the disease is rarely seen in the North; in the South and in the tropics, however, it is much more common.

It may be caused by the tertian, quartan or estivo-autumnal forms of the parasite, but much more commonly by the last.

One of the best criteria, aside from the severity of the symptoms, for a pernicious infection, is that set by some of the Tropical workers; namely, the percentage of infected cells and the number of doubly infected cells.

When 5 per cent. of the red cells are infected the case trespasses upon the dangerous.

The fever is usually irregularly remittent or constant.

The dose recommended is larger than those usually given in temperate climes. While Rogers recommends gr. x (0.66 Gm) three times a day, James urges gr. xlv (3 Gm) a day, in doses of gr. xv (1 Gm) three times a day for at least ten days and Wellman gives gr. xx–xxx (1.30–2 Gm) for an initial dose, followed by gr. x–xx (0.60–1.30 Gm) every four hours, until the attack clears up (one to four days), then about gr. xx a day.

The profound intoxications are seen more commonly in those who have had repeated attacks or in neglected cases, and in those in whom resistance has been lowered from one cause or another.

Profound depression of all the vital centres is seen, and a particular imposition of the poison on one or the other organ gives a stamp to the picture and affords abundant cause for error in diagnosis.

Thus we have a comatose form in which sudden loss of consciousness resembles apoplexy; apathetic conditions with icterus, like yellow fever; diarrheas that resemble cholera or dysentery; and not infrequently an attack characterized by profound prostration, collapse, excessive sweating, sometimes subnormal temperature, the algid form.

In these cases quinine must be used hypodermically or intravenously according to the urgency.

Hypodermic Use. The best salt for hypodermic use is the acid hydrochlorate, which dissolves in less than its own weight in water. Make up a solution as follows:

Hydrochlorate of quinine	5 Gm
Distilled water	10 c.c.

This method, necessary in this class of cases is not free from disagreeable results and in exceptional circumstances real danger.

As commonly used, the solutions are too concentrated, the result being that a precipitate from the serum is caused by the quinine and the tissues may undergo necrosis.

The more dilute the solution the safer the procedure becomes; so that a hypodermoclysis is the procedure of choice of some men of experience.

One may take m. xv (1 c.c.) of the solution given above and dilute to ʒiiss (10 c.c.); better ℥ss (15 c.c.) or better yet ℥i (30 c.c.) and slowly inject under the skin where the subcutaneous tissue is loose or into the muscle.

The amount needed in the twenty-four hours is some 24 grains, given in divided doses in this way. In worst cases up to gr. xlv (3 Gm).

In these severe but less urgent forms, if given by the mouth, the amount should run up to the full doses of Wellman given above.

One should take every precaution to be assured of a sterile needle, syringe and skin, and should inject into the gluteal region or muscles of the back and go down deep into the muscle. There is likely to be some pain and induration but this probability is greatly lessened by the high dilutions.

Another preparation of quinine which is excellent for hypodermic use and freely soluble is the **bimuriate of quinine** and **urea,** to be used in the same dose.

Hypodermoclysis. The same preparation in a gr. xv (1 Gm) dose is used in 2 to 3 pints (1,000–1,500 c.c.) of salt solution (ʒi–Oi) (4 Gm–500 c.c.). In diarrheal forms and in collapse this should be an especially valuable method.

Intravenous Use. In urgent cases, it may be deemed advisable to put the drug into the vein. This may be done in physiological salt solution. For example:

Hydrochlorate of quinine	0.50 Gm	gr. vij ss
Sodium chloride	0.25 Gm	gr. iij
Water	30. c.c.	℥i

or twice this dilution. In most urgent cases two and four times the dose gr. xv–xxx (1–2 Gm).

Inject all at once into the basillic vein made prominent by a ligature as above.

Other veins if more accessible may be chosen.

A word more about quinine before we proceed with our subject. This drug is an antipyretic and used as such under certain circumstances. Its antipyretic action is apparently due to the depression of function of protoplasm, of which mention has been made. Some effect, too, upon ferment action can be determined. The result is a lessened output of heat from the tissues, through direct action and not through the intermediation of the heat regulating nervous mechanism. It must be remembered, however, that in malaria the control of temperature is to be attributed entirely to the destruction of the plasmodium and not at all to this pharmacological action.

Cinchonism. Of more importance to us are those toxic symptoms that may occur when inordinate doses of the drug are given, and so can be avoided; and which occur after very small doses in certain people, whose reaction to the drug constitute an abnormality which we call an idiosyncrasy, and cannot be avoided. Idiosyncrasy is one of those philological accomplishments, sent as an advance agent to occupy a territory until knowledge shall advance. It is the shadow rather than the substance of a thing, but like many other shadows in affairs temporal it is allowed to usurp and continue to rule as the real thing. It is derived from two Greek words, *ἴζιος*, own, and *συγρασις*, mixture,—having its own mixture, that is a quality peculiar to the individual. What that quality is and how it operates is left for the future to elucidate.

These toxic symptoms are called "cinchonism."

The earliest and most common are **ringing or roaring in the ears** and a **mild degree of deafness.** If it amounts to no more than this we give it no consideration, but this may go on to complete deafness.

This has been attributed to congestion and hemorrhages in the tympanum, but Cushny believes, in the light of recent research, that this view is not correct, but that the phenomena are attributable to degenerative changes occurring in the spiral ganglion in the cochlea.

Less frequently than the hearing, the **vision is** affected. The field of vision is contracted, the color vision disturbed, and **blindness** may ensue.

The visible changes in the eye are contraction and even obliteration of the retinal vessels, sometimes degenerative changes in the retinal nerve-cells and even atrophy of the optic nerve.

Skin eruptions occur in great variety. The most common is an **erythema** that has been mistaken for scarlatina, an illusion heightened by the fact that it may desquamate; next to that, **urticarial wheals. Hemorrhagic rashes** also occur, which on occasion may give rise to the diagnosis of a septic process. Less commonly, the drug may cause **gastric discomfort** of a marked degree and is believed at times to cause **hemorrhage from the kidneys.** In a case of malaria this may give rise to the diagnosis of black water fever and, indeed, Koch maintains that black water fever is due to quinine.

Contraindications to Quinine. When idiosyncrasies do exist to a marked degree they constitute contraindications to the use of the drug.

Further contraindications are any inflammatory process in the middle ear or labyrinth, amblyopia and amaurosis.

Pregnancy is said to contraindicate the use of quinine because of its effect on uterine muscle substance, but the best opinion voices the greater danger of abortion and miscarriage from the untreated malaria.

SYMPTOMATIC TREATMENT OF PERNICIOUS MALARIA

Collapse. In the pernicious form indications must be met as they arise. For collapse, stimulation with strychnine or caffeine is required, and in the more urgent cases more rapidly acting agents should be used, such as camphor, adrenalin or ammonia inhalations.

Algid Form. In the algid form the body heat must be maintained by hot drinks containing coffee, brandy or whisky; by blankets and hot bottles or bricks about the body and the hot-water bag at the feet; and by hot rectal injections containing coffee.

Choleraic Form. In the choleraic form the same line of treatment with hypodermoclysis or venous infusion of warm salt solution.

Morphine is to be injected to control the peristalsis.

Hyperpyrexia is best controlled by cold baths, at 65° F. or beginning higher at 85° F. to 90° F., and cooling to 65° F., sponging the head meanwhile. This is continued until the temperature is reduced below the danger point.

For extreme nervousness morphine is the best, because the least depressing and most effectual of the sedatives.

Sequelæ. After the severe infections there are certain sequelæ that are possibilities that must be taken into consideration.

The first of these are the **mental disturbances,** delusional insanity, mania and most common of all melancholia.

Sharp watch must be kept of these exhausted subjects to appreciate any mental aberration, any depression presaging melancholia, with its self-destructive impulses.

Kidney Complications occur. Albuminuria is frequent during the attacks, in some 30 per cent. of the tertian and quartan, and

50 per cent. of the estivo-autumnal. This must not be taken too seriously, as real nephritis rarely ensues in the milder forms of the disease. Taking the estivo-autumnal form and the severe infections it induces in the tropics, nephritis, as a sequel, will amount to nearly 3 per cent. and is usually of the chronic parenchymatous variety.

These conditions are to be treated in the same way as if arising from any other cause.

Large liver and large spleen may persist without symptoms of any kind attributable to any interference with their functions.

Anemia. The marked degree of anemia accompanying malaria has never been satisfactorily explained, as the destruction of cells has been out of all proportion to the number of parasites seen.

Obviously there was another factor operative upon uninfected red cells that made them share in the destruction, some hemorrhagic dissolving substance as Manson put it or a toxin from the plasmodium acting on uninfected cells as Ewing conjectured. Very recently two theories have been advanced, one by Wade Brown who on the basis of experimentation attributes the phenomena or believes them influenced by the hematin set free from the infected cells; and that of Mary Rowley Lawson, who has observed the constant migration of the plasmodium, from cell to cell resulting in their destruction. This migration is seen in parasites of all ages.

After the tertian and quartan infections, repair of the blood is rapid; after the estivo-autumnal form less so.

Good food, air, change of surroundings, iron and **arsenic** all help recovery.

RELAPSES

The relapse is more to be dreaded than the initial attack. It is more fatal, it is more persistent and less amenable to treatment and it finds the patient reduced and less able to resist. Undue exposures to wet and cold and the occurrence of other diseases invite a relapse, but one great factor responsible for relapses is, as James has emphasized, an insufficient quinine treatment of the initial attack.

He believes that the relapse is due to a renewal of the vitality of the asexual cycle, which is endowed with a large "potential of vitality" and that the asexual cycle can become relatively immune to the protective forces of the body and also to quinine; that is, can become "quinine-fast."

During a relapse the large dose by the vein gr. xxij–xxx (1.25–2 Gm) as above is indicated and a plea is made for larger doses in all forms of the initial infection.

Malarial Cachexia. There are, however, cases in which repeated attacks have occurred, where the treatment has been neglected or been insufficient, where a chronic poisoning is set up that is termed malarial cachexia. These patients show but few organisms in the blood. These are usually the estivo-autumnal form, and are not easy of demonstration. The patients are markedly anemic, with the type of secondary anæmia; are emaciated, nervous and constantly fatigued, and have a poor appetite and readily get short of breath.

Next to the anemia the enormous size of the spleen is the most notable clinical manifestation.

These cases should be **removed from the malarious district** in which they reside, to one free from infection: to the mountains or to a suitable seashore resort. If this cannot be done, attempts must be made to **protect the patient from further infection,** that is, bites of mosquitoes, by choosing an upper room, and taking special care to avoid exposure toward nightfall.

Quinine should be begun at once. It has been the custom to give such doses as **quinine** gr. iv three times a day, or in more severe cases up to gr. xvi or gr. xx a day until the slight afternoon rise of temperature that usually accompanies the infection subsides. Then the dose of gr. iv three times a day is cut down to gr. iii and gr. ii three times a day and continued in these doses for weeks.

I think these doses are insufficient, for the cachexia usually means an insufficient quinine administration in the initial attack and the persistence of the malarial organism in a form peculiarly resistant to quinine.

Quinine doses should be as rigorous, then, as in a well treated initial attack and if this does not answer the use of the drug hypodermically or intravenously in doses of gr. xx (1.30 Gm) a day is indicated.

Iron and **arsenic** are of great help in these cases to improve the blood state.

Iron. Iron may be given in the shape of a carbonate of iron or other iron preparation. I prefer the carbonate, e.g., pilula ferri carbonatis (Blaud's) gr. v (0.30 Gm) one, three times a day.

Arsenic. Arsenic may be given as Fowler's solution, liquor potassi arsenitis, m. iii (0.20 c.c.), increasing m. i (0.075 c.c.) each day up to m. viii or x (0.50–0.75 c.c.) three times a day or to the point of some manifestation of intolerance, as suffusion of the eyes or gastric disturbance.

Iron and arsenic may be combined in pill form, e.g.:

℞—Massæ ferri carbonatis (Vallet's mass) ...10.00 Gm ʒijss
Acidi arsenosi .... 0.05 Gm gr. ¾

Massa fiat in pilulas numero xxx dividenda. S. one three times a day.

This gives us gr. v (0.30 Gm) of the mass of carbonate of iron and gr. 1/40 (0.0015 Gm) of the arsenious acid at a dose.

The **nervous manifestations** may be helped by **strychnine** in doses of gr. 1/40 (0.0015 Gm) to gr. 1/30 (0.0020 Gm) three times a day, taken with the iron and arsenic; and, indeed, they may all be incorporated in one pill or capsule. One should always know that the pills ordered are fresh.

Plenty of **fresh air** and sunshine are even more important than drugs. **Good food** and plenty of it to make good the extensive tissue destruction; **cool baths, showers, light massage** and **exercise**; at first by walking, later, as the patient's strength returns, by golfing and horse-back riding, and at the shore by swimming complete the treatment.

Substitutes for Quinine. What is to be done if the patient cannot take quinine?

I hesitate to offer any substitute because there is no other that is even remotely comparable to quinine and the "cannot" is often a prejudice on the part of the patient, or a result of ignorant usage, as colossal dosage, insoluble pills, and nauseous mixture. Again the little disturbances of hearing are interpreted too seriously and further effort to continue the drug is given up. Idiosyncrasies of serious import are very rare.

It is a detriment both to the physician and patient to convey the idea that anything else is nearly as good, or is a fair substitute.

Methylene-blue has been advocated as such. It is a very poor substitute. If, however, we are actually debarred from using quinine, then we may try it in doses of gr. viiss to gr. xv (0.5–1 Gm) a day, divided into three or four portions.

One should remember to warn the patient that the drug will lend color to the urine, a rather startling phenomenon to a patient who is not informed, and that strangury or diarrhea, intervening in the course of treatment, may be due to the drug.

Arsenic, both inorganic, as Fowler's Solution or the oxide and organic, as atoxyl, soamin and salvarsan have been used, but with no very encouraging results.

Convalescence. **Change of air** and especially a **removal** from a malarious district; **open air** and **increase in the diet,** with such drugs for the anemia and such tonics as were named under Cachexia with a repetition of the quinine series as mentioned above are the considerations to be borne in mind during convalescence.

Prophylaxis. We are so well informed now as to the sequence of events in malarial infection, as to the rôle of the mosquito, the individual and the malarial organism, that our prophylaxis is clearly defined in measures aimed at the three links in this chain.

Destruction of the Mosquito. The mosquito like Carthage "delenda est" and medical Catos have arisen to reiterate the slogan.

Mosquitoes breed in marshes, ponds, pools or any receptacle of quiet water, even cisterns, buckets or tin-cans.

Where municipalities have become sufficiently interested or in certain territories under control of the Federal government, vast stretches of **marshes** have been **drained** for the extermination of the mosquito or, in smaller areas, **water-containing depressions** have been **filled in.**

Where communities are ignorant and careless, brigades of mosquito exterminators have been formed, whose business it is to see that cisterns and water **receptacles** are **screened,** that small **pools** are **filled,** rubbish containing water disposed of or a thin layer of **kerosene** poured on the surface.

Kerosene is the most effectual substance used to exterminate the mosquito over extensive surfaces of water. The larvæ of the mosquito have to come to the surface of the water to breathe. The oil prevents their access to the air and fills their air-channels.

Protection of the Individual. Education in schools, public lectures, disseminated literature, explaining to individuals how proper methods may be used in their own environment, is one of the prophylactic measures of the highest import, for through this means both personal and civic responsibility is cultivated.

Numerous odorous substances have been used to kill the mosquito in a closed space, the best of these is pyrethrum or pellitory, which contains an acrid resinous-like substance, which when the powder is burned, gives fumes that stupefy them.

Sulphur is more certain in its effects when burnt in the proportion of two pounds to each 1,000 cubic feet.

If the mosquito cannot be destroyed, the individual may be kept from their attack. This has a double significance. It prevents the man from becoming infected, or being infected, from infecting the mosquito to pass it on to another man.

Isolation may be effected by the use of screens in windows and doors, by choosing a room in the upper stories for a sleeping room. If the individual lives in a badly infected district, he should **avoid going out after sunset** or before sunrise unless his **head** is **protected** by a veil worn over the hat, his **hands** by gloves and his **ankles** by boots. In the tropical forests such precautions are necessary even by day.

Applications, such as oil of pennyroyal, oil of eucalyptus, camphor, citronella, may be made to the skin, the odor of which is said to keep the insects away, but these are not trustworthy.

℞—Oil of pennyroyal		
Oil of citronella ....āā	1 ounce	30 c.c.
Alcohol up to	8 ounces	240 c.c.

Mix and apply locally.

Going into malarious districts, at the season of the year when infection occurs, or if living in malarious districts, **prophylactic doses of quinine** should be taken: gr. ii (0.120 Gm) three times a day or slightly larger doses, gr. vii to x (0.50–0.60 Gm) two or three times a week.

Wellman recommends gr. xv (1 Gm) on two successive days of each week for a period of two months.

Finally, as the infection may die out of itself in certain instances, we know that the body has the power of elaborating protective substances, so that it may repel lesser infections and mitigate severe ones. To do this the body must otherwise be in good health and all measures aimed at excellent physical condition should be considered for those living in exposed districts.

Alcohol does harm and it should not be used in the tropics at all. Arctic explorers tell us it should not be used in the North, so, it would seem that the temperate zone would have a hard battle to justify its designation.

Finally, the malarial organism is attacked in the body of the man, by the use of quinine, before it has had time to multiply and give rise to the characteristics of the disease.

BLACKWATER FEVER

It is not becoming, nay, it is dangerous for me who have had no practical experience with this condition to write dogmatically of its treatment.

The great uncertainty among those who have had an abundant opportunity to study the disease should lead a practitioner taking up tropical work to review the literature with care.

For the student I will merely outline a conservative view of its therapy.

The condition gets its name from the hemoglobinuria, one of its most obvious symptoms.

The whole picture seems to be a tremendous hemolytic crisis, and although some writers have been inclined to look upon it as an entity separate and independent of malaria, this view can scarcely be maintained and malarial infection seems to be the *sine qua non,* a direct etiological agent. Such an expression of malarial infection, however, needs the intercalation of yet another cause or causes for its eventuation. These have been offered, from vague conjectures (see anæmia above) to conclusions derived from experiment; for example, Bass and Johns, noting the effect on hemolysis of calcium salts added to their cultures, have surmised that an increase of these salts in food and drink might be etiologically concerned in Blackwater Fever. Wade Brown, studying the effects of alkaline hematin, has considered it an hemolytic element, while the views of Koch and others of the part played by quinine in inducing the onset are well known.

Symptoms. Its cardinal symptoms are fever, vomiting, jaundice and hemoglobinuria.

Treatment. All rules applicable to the treatment of malaria (barring quinine) are indicated here, except that the insistency on rest must be greatly emphasized and the patient considered as having sustained a severe hemorrhage (as indeed, he has).

Stimulation is often needed and must be vigorous.

As regards the administration of quinine, we are advised to use it vigorously, we are advised to use it cautiously, we are advised to use it only when the parasites are found in the peripheral circulation, and we are advised not to use it at all.

Personally I am much influenced by the attitude of Lovelace (see *Archives of Internal Medicine,* June, 1913), which seems safe and sane and based on a considerable experience.

He has been impressed as have others, by the sequence of quinine administration and outbreak of the hemoglobinuria, by the fact that it has never occurred in his experience in the initial attack, but always in cases of relapse and in weakened individuals and in those who took their quinine irregularly as a prophylactic or insufficiently when attacked.

He would, then, **under no circumstances give quinine** during an attack of Blackwater Fever nor for several days after, not until the urine has cleared up, hemoglobin casts no longer being seen and the icterus quite or nearly cleared up.

Then an effort to stamp out the malarial infection is made by using quinine with great caution.

He begins with 1 grain doses (0.075 Gm) of quinine tannate (because one of the weakest salts) three times a day, and gradually works up to 20 or 30 grains (1.30–2 Gm) of the hydrochloride daily.

Prophylactic. The daily use of quinine gr. vi to x (0.40–0.60 Gm) or gr. xv once or twice a week, and an efficient treatment of initial attacks.

SUMMARY

Rest in bed.

- Bed. Preferably single. Hospital type.
- Room.
  - Well ventilated.
  - Upper story preferred.
  - Screened.
  - Freed from encumbrances.

Diet.

- Make no effort to feed during a paroxysm, very light diet, only fluids within six hours of a paroxysm.
- In intervals of paroxysms semi-solid food of simple character.
- In remittent type of fever (estivo-autumnal) consider caloric needs and proteid demands. (See Chap. II.)

Symptomatic Treatment during the Paroxysm.

- Care of the bowels.
  - Calomel, gr. iii–v (0.20–0.35 Gm) or in divided doses, gr. ¼ (0.015 Gm) every quarter hour for six or eight doses.

  - This may be followed in three to four hours by a saline.
  - Magnesium sulphate (Epsom salts).
  - Sodium sulphate (Glauber's salts), or
  - Sodium and Potassium tartrate (Rochelle salts) ℥ss–℥i (15–30 Gm) in half to three-quarter glass of water.
  - Best time to give cathartic is between the paroxysms, but before the quinine.
- Chill.
  - Heat.
  - Hot water bags or bottles to feet.
  - Flannels about the extremities.
  - Blankets.
  - Hot drinks, water, weak tea, lemonade, whisky or brandy.
- Vomiting.
  - Effervescing drinks, charged water, champagne.
  - Mustard paste to epigastrium. One part of mustard to three or four of flour; mix with cold water, spread between linen or cheesecloth, leave on ten to fifteen minutes or until well reddened.
- Retching.
  - Draughts of warm water.
  - Bicarbonate of soda, ʒj (4 Gm) in a glass of warm water.
- If very severe.
  - Morphine hypodermically, gr. 1/12–1/8 (0.005–0.008 Gm).
- Collapse.
  - Hot drinks, coffee, brandy, whisky, aromatic spirits of ammonia ʒi (4 c.c.) in ℥ii–iv (60–120 c.c.) water.
  - Strong water of ammonia to inhale.
- Fever.
  - Cold.
  - Cracked ice to suck.
  - Cold water, cold lemonade.
  - Cool sponges of water or water and alcohol.
  - Light rubs with 25 per cent. alcohol.
- Headache.
  - Cold cloths to forehead.
  - Ice bag to head.
  - If intense, morphine hypodermically, gr. 1/24–gr. 1/12 (0.003–0.005 Gm).
- Sweating.
  - Change night-dress and sheets.
  - Rub body with dry towels.
  - Drinks of water and lemonade.
- Collapse. (See under Chill in summary.)

Specific Treatment.

- Quinine.
  - May be given a few hours before an expected paroxysm.
  - May be given at the decline of the fever of the paroxysm, or may be divided into two or more doses during the day.
- Oral administration.

Give in capsules, each gr. ii (0.15 Gm), or

Give in solution; bihydrochlorate is very soluble; bisulphate 1 in 10; or dissolve sulphate in any dilute acid, dilute sulphuric, aromatic sulphuric, dilute hydrochloric, phosphoric or tartaric, m. i per gr. i.

Good method.

Dissolve the dose in a few grains, e.g., gr. x (0.60 Gm) citric acid in lemon juice, add water and a pinch of bicarbonate of soda and drink effervescing.

Dosage.

Gr. xxx (2 Gm) of quinine a day until the paroxysms cease, then gr. xx (1.30 Gm) a day for ten days to fourteen days, then gr. xv (1 Gm) on two successive days (e.g., Saturday and Sunday) each week for two months.

Doses may be divided as gr. xv (1 Gm) twice a day, or gr. x (0.60 Gm) three times a day.

Quinine in children.

Gr. i (0.060 Gm) three times a day for each year of the child's age or, better, larger doses.

(Holt) Infants one year, gr. 8 to 12 (0.50–0.75 Gm), five—ten years, almost as much as adult doses.

Give quinine in solution by the mouth to infants.

To small children give in syrup of Yerba Santa or by rectum in two to three times the oral dose. Give in solution or starch paste.

Treatment of Pernicious Infections.

Quinine, gr. x (0.60 Gm) three times a day (Rogers).

Quinine, gr. xv (1 Gm) three times a day for at least ten days (James).

Quinine, gr. xx–xxx (1.30–2 Gm) for an initial dose, followed by gr. x–xx (0.60–1.30 Gm) every four hours until attack clears up (one to four days), then gr. xx a day for a series of days.

The evidence is in favor of the liberal dose.

Very severe forms, comatose, choleraic, algid, etc.

Quinine, subcutaneously, intravenously, or intramuscularly; must be very dilute, 1 in 20–30 or more.

Subcutaneously or intramuscularly.

E. g. Hydrochlorate of quinine, gr. viiss (0.5 Gm) in ʒjjss (10 Gm) of water or in ℥ss (15 c.c.) water.

Inject slowly into loose tissue or muscle.

Total daily dose, gr. xxiv–xlv (1.60–3 Gm).

Hypodermoclysis.

Use gr. xv (1 Gm) of the hydrochlorate of quinine or the bimuriate of quinine and urea in 2 to 3 pints (1,000–1,500 c.c.) of salt solution (ʒi to Oi) (4 Gm to 500 c.c.) and allow to flow slowly from an irrigator or sterilized fountain syringe into loose tissue under breasts, in abdominal wall, loose tissue of flanks. Temperature at needle should be about 100° F. A short, large calibred tube from irrigator lessens loss of heat.

This is particularly indicated in choleraic cases and in collapse.

- Intravenous use.
  - High dilution, one in twenty, better thirty or more.
  - Any highly soluble form, as above.
    - Dose, gr. viiss–xxx (0.50–2 Gm).

  - For example.

Hydrochlorate of quinine ..	0.5–1 Gm (gr. viiss–xv)
Sodium chloride	0.25 Gm (gr. iii)
Distilled water	30 c.c. (℥i)

  - Inject into basillic vein made prominent by ligature.
  - Other veins may be chosen.
  - For details of technique see Rheumatism, Chap. III.
  - For toxic manifestations (cinchonism and idiosyncrasies) see text.
  - For contraindications see text.

Symptomatic Treatment of Pernicious Malaria.

- Collapse.
  - Stimulants.
    - Caffeine sodium salicylate or caffeine sodium benzoate, gr. v (0.30 Gm) hypodermically.
    - Camphor (10 per cent.–20 per cent. in oil), gr. v (0.30 Gm) hypodermically.
    - Strychnine sulphate or nitrate, gr. 1/30 (0.002 Gm) hypodermically.
    - Follow by strophanthin, gr. 1/120 (0.0005 Gm) hypodermically.
  - More urgent cases.
    - Inhalations of strong water of ammonia on towel.
    - Adrenalin, m. xv (1 c.c.) intramuscularly or m. iii intravenously.
- Algid Form.
  - Heat.
    - Hot drinks; water, coffee, lemonade, brandy or whisky.
    - Hot water bottles to feet and extremities.
    - Blankets.
    - Hot rectal injections 105° F.–110° F. of water or salt solution containing strong coffee.
- Choleraic Form.
  - Same as algid, with hypodermoclysis or venous infusion of warm salt solution (.6 per cent.).
  - Morphine—gr. 1/8–1/4 (0.008–0.015 Gm).
- Hyperpyrexia.
  - Cold baths at 65° F. or at 85° F.–90° F. and cooling to 65° F.
  - Ice in tub to keep temperature down.
  - Sponge head with cold water during bath.
  - Take patient out at 102.5° F.–103° F.

Extreme nervousness.

- Morphine, gr. 1/16–1/8 (0.005–0.008 Gm).
- Keep sharp watch on exhausted patients, who develop psychoses.
- Nephritis—treat as under other circumstances.

Anæmia.

- Abundant diet.
- Fresh air.
- Change of surroundings.
- Iron and arsenic. (See below under Cachexia.)

Relapses.

- More resistant to quinine than initial attack.
- Treat intravenously, gr. xxijss–xxx (1.50–2 Gm) daily.
- (See above in summary.)

Malarial Cachexia.

- Remove from a malarial district or protect from further infection. (See Prophylaxis.)
- Quinine.
  - Treat as rigorously as a severe initial attack. (See summary above.)
  - If this does not answer use the drug intravenously in doses of gr. xxijss–gr. xxx (1.50–2 Gm) a day.
  - When slight temperature has subsided or a course equal to that given in a severe initial attack has been administered,

Treat anæmia.

- Iron.
  - Pills of carbonate of iron (Blaud's) or Vallet's mass (Massa ferri carbonatis), gr. v to x (0.30–0.60 Gm) three times a day.
- Arsenic.
  - Fowler's Solution (Liq. potassii arsenitis) m. iii (0.2 c.c.) three times a day, increasing m. i (0.060 c.c.) a day up to m. viii–x (0.50–0.75 Gm) three times a day or to point of tolerance, (suffusion of eyes, puffiness under eyes, gastro-intestinal disturbances).
  - Combined iron and arsenic.

℞

Massæ ferri carbonatis	10.00	ʒiiss
Acidi arsenosi	0.05	gr. ¾

Massa fiat in pilulas numero. xxx, dividenda.
S. One or two three times a day.

Nervous manifestations.

- Strychnine, gr. 1/30 (0.002 Gm) three times a day.
- Fresh air.
- Abundant diet.
- Cool baths.
- Massage.
- Graduated exercises.
- Substitutes for quinine.
  - None efficient.
  - Methylene blue, gr. viiss to gr. xv (0.50–1 Gm) in divided doses.
- Arsenic.
  - Fowler's solution.

Atoxyl.
Soamin.
Salvarsan.

Convalescence.

(See under cachexia, change of air, diet, hygiene, iron, arsenic, etc.)

Prophylaxis.

Destruction of the mosquito.
Draining marshes.
Filling in depressions.
Screening receptacles of water.
Kerosene in pools.
Pyrethrum and sulphur. (See text.)

Protection of the individual.

Education.
Sleeping in upper rooms.
Screening rooms.
Avoid going out after sunset and before sunrise unless protected.
Head with veil.
Hands with gloves.
Ankles with boots.
Applications to skin (very little value). (See text.)
Prophylactic doses of quinine most important, gr. xv (1 Gm) quinine on two successive days each week or gr. x (0.60 Gm) every day.
Keep body in good health.
Avoid alcohol.

Blackwater Fever

Treatment.

All rules for treatment of malaria applicable except quinine.

Use of quinine.

Lovelace's rules. (See text for detail.)
No quinine during the attack and for several days after. Then gr. i (0.060 Gm) of the tannate of quinine three times a day and gradually work up to gr. xx–xxx (1.50–2 Gm) of the hydrochlorate daily.

Prophylaxis.

Daily use of quinine, gr. x (0.60 Gm), and an efficient treatment of the initial attack.
Relapses and chronic cases are candidates for Blackwater Fever.

CHAPTER VII

DYSENTERY

BACILLARY DYSENTERY

Dysentery is a term used to designate a morbid condition, characterized by inflammation of the colon and, occasionally, of the lower end of the small intestine as well; hence, it is a colitis or enterocolitis.

It is an acute infectious process which, on etiological grounds, can be divided into two diseases: (1) Amebic dysentery, due to the invasion of the mucous membrane and neighboring tissues by a protozoön, the **Entamœba histolytica,** and (2) bacillary dysentery, due to the pathogenic action on the same structures of a bacillus, or of members of a group of bacilli, spoken of as the **Bacillus dysenteriæ.**

The pathological changes of either type have certain distinguishing marks of their own; the symptoms vary somewhat and the sequelæ are not identical; and yet the two are so nearly alike that without the finer aids to diagnosis, the use of the microscope and culture, they may readily be confused.

The bacillary form is the one peculiar to this climate and to the United States, though amebic dysentery is every year more frequently met with even in this city and among those who have not been in the tropics; first, because the stools of dysentery are constantly more carefully examined and, secondly, because, since the acquisition of tropical possessions, more patients are invalided home to disseminate the disease.

The short incubation of two or three days, the rather sudden onset, with fever, diarrhea, colicky pain and tenesmus, the appearance shortly of mucus in the stools, streaked with blood, later looking like chopped or shredded beef that has been washed out in water, are merely mentioned here to recall what the condition and symptoms are which we have to consider in the treatment.

Therapy. There are few self-limited infectious diseases that are accompanied by such continuous, nagging discomfort and distress as dysentery. Our ingenuity is exercised to the utmost, not merely in the efforts to shorten the process, but even in attempts to afford some comfort. For success much depends on ability to secure rest.

Rest. One might assume that the train of events in dysentery would compel rest, and so, indeed, in severe cases it does, but in the cases that in their incipiency promise to run a mild course it is often difficult to get the patient to bed; and his failure to accede to such advice may determine a very severe process in what might otherwise have been relatively benign.

Rest in every case is desired both for the body at large, suffering from the effects of the toxins of disease and of pyrexia, to shelter metabolism by avoiding unnecessary work and so diminishing the demand for food to meet such metabolic needs and sparing the organs concerned in digestion, assimilation and utilization of these foods, but also for the particular organs or tissues that chance to be the sites of lesions caused by the disease; in this case, the large intestine. Now, the large intestine is a receptacle for certain materials, in part passed on from above, in part excreted from its walls. In this material fermentative and putrefactive processes are going on as the result of bacterial action. From this material, water and certain substances in solution are being absorbed. This structure, the bowel, is in a condition of active muscular exercise, the site of peristalsis, of a swinging pendulum movement, and finally is pressed upon and massaged by contiguous structures as the result of the action of the muscles surrounding the abdominal cavity, from which arises so great benefit from walking and gymnastics directed to the abdominal muscles in constipation. It will be our effort to diminish the activities of the large intestine, that is, to secure rest. By putting the patient to bed we avoid the squeezing and massaging due to muscular action and so take away one stimulus to increased peristalsis; an important factor, considering the hyperactivity of this function, upon which the frequency of the movements and the colicky pain so largely depends.

Even the bed is a bed of unrest, for the griping pain is always forcing the patient to seek some position to relieve it.

Bed. Far more work is to be done about this bed by nurse or attendant than about the bed even of a typhoid fever case. The constant use of the bed-pan, the soiling that necessitates changing of the bed-linen, the soothing applications to be made, the irrigations to be given, all demand as much economy of effort as can be procured by favoring conditions to work under. The bed, then, should be chosen with care. It must be a **narrow or half bed,** best of the **hospital type,** which is about 6 feet 6 inches long, 36 inches wide and 24 to 26 inches high. The **spring of woven wire** must be stiff and the **mattress of hair** preferably firm. Over this is placed the **sheet,** long enough to tuck well under and draw smooth and taut. If the surface of the mattress is not smooth a **folded blanket** under the sheet will make it so.

Over the sheet is put a **rubber-sheeting** that should extend from the pillow to the bend of the patient's knees and wide enough to tuck under. Over this comes the important **draw-sheet,** a long sheet folded lengthwise and laid across the bed covering the rubber-sheeting and tucked far under one side. This sheet can be drawn toward the other side, little by little, to afford a cool fresh surface under the patient from time to time, or, if soiled, can be replaced without remaking the whole bed. Over the patient is placed the upper sheet and one or two blankets arranged with a view to comfort.

It is very well to have a second bed of the same kind, to which a patient can be drawn while the mattress and clothes of the first are airing.

Room. Every sick-room should be large, **well ventilated,** and should get sunshine. As, however, the disease is far more common in the summer than at any other time of the year, it is well to select a room in which there shall be shade the most of the day. Morning sun and afternoon shade are, of course, ideal. If there is a **balcony** on which the patient can be wheeled it will, if it is properly screened, serve as the best room possible in the warm season.

A bath room contiguous to the sick-room is extremely desirable, saving much labor of fetching and carrying, as is obvious.

The odors, which in some cases are very offensive to the patient as well as to attendants, may be mitigated by good ventilation, by one of the many deodorants on the market, whose claim to disinfect the community when a few drops are shaken here and there must not be taken seriously, by the burning of joss-sticks, etc.

Care of the Body. A cleansing bath should be given each day, if there is a skilled hand to administer it or the manipulation does not cause too much exhaustion.

It is given between blankets, the patient divested of his night-shirt, being rolled on one and covered by another. Soap and warm water at 110° F. is used, one part of the body after the other being exposed and attended to and then dried.

The feet may be placed in a small foot-tub in the bed, the knees being drawn up. After the bath the skin may be rubbed with alcohol and dusted with drying powder—one of the numerous talcum or toilet powders in use.

An approximation to this detail can be attained by an attendant in the family, if care is exercised.

The **mouth** should be attended to by **rinsing after every feeding** and, if in bad shape, carefully cleansed by gauze or absorbent cotton around the finger of the nurse or on some applicator after dipping into some cleansing solution, like **boric acid 2 per cent. to 4 per cent.,** a **Dobell's solution,** or half strength Listerine. If very bad, **peroxide** diluted one-half with water or salt solution may be used before the mouth-wash.

When the mouth is very dry, equal parts of albolene and 2 per cent. boric acid solution with a little lemon juice gives relief. **Glycerin** is sometimes used, but if the mouth is very dry, it may be aggravated by the glycerin which takes up water so readily.

Constancy of attention and patience are needed to nurse these cases properly, because the restless patient is disarranging the clothes and seeking a comfortable position every moment. The knees are often drawn up to lessen the tension of the abdominal muscles, a hard position to maintain as the feet slip on the smooth sheet. A folded blanket or pillow under the knees gives comfort.

Rings and **air-cushions** may be needed to take the pressure off the bony parts daily becoming more accentuated.

Nothing is more striking and real than the intangible something we call the "atmosphere" of the room, and it is the ability of the trained hand to secure order, neatness, quiet and calm that gives courage both to the patient and doctor.

Frequent visitors, garrulous friends, Job's comforters, pedlars of similar experiences, *id genus omne,* are to be excluded as a part of the treatment.

The **bed-pan** in this disease is the most important article in our armamentarium, and its skilful use is imperative. The distressing condition that obtains in some of these cases is hard to appreciate unless witnessed. I have seen stools coming every fifteen minutes with tenesmus that deprived the patient of all sense of relief after the stool, and keeping up for hours, until the patient begged that the pan be not removed at all.

The pan should be warmed before using, the patient's knees flexed and a hand placed under the lower part of the back to raise him. The same thing is done on taking the pan away. Either a clean pan can then be slipped under the patient or a towel may be placed under the pan to begin with, upon one or the other of which the patient lies while the parts are carefully cleansed, dried, rubbed with alcohol and dusted.

It is very essential in this disease that the patient's body and abdomen should be kept warm, as chilling aggravates the diarrhea. **Woolen material should be worn over the abdomen.** If the feet are cold the hot water-bottle is to be used.

Diet. During the first few days of the attack, when the stomach is often very sensitive to food, and nausea and vomiting are a feature, and while the evidences of intoxication are most marked and peristalsis most active, the quantity of food is of less importance than the quality.

The food must be bland, non-irritating and non-stimulating to the gastro-intestinal tract, must be readily assimilable and leave but little residue, and must be concentrated, especially with reference to its proteid content. All these conditions are met by milk better than by any other food.

It has been my lot to have a great many cases of dysentery to treat. Most of them, to be sure, were of the moderate type, but not all.

It has been my routine to put the patient on a **milk diet,** ordering the milk boiled and given every two hours, the patient is to take what he will of 8 ounces.

Why boiled milk should be any better, if as good, as clean raw milk in this condition, I cannot offer adequate explanation. I can only plead handing a leaf out of the book of my own experience. If the patient prefers it raw, or boiled milk distresses him, I do not persist in my prejudices. At the beginning of the attack, especially if there is much fever, I dilute it ¼ or ⅓ with plain boiled water, or barley water or rice water. Preferably plain water. If there is a coated tongue or flatulence or the milk does not seem well borne, I suspect that the fat is not well borne and have the milk skimmed.

I believe the experience of our pediatric practice with reference to intolerance for fats can afford us practical information in its usage in adults.

When the temperature disappears and the stools have lost their diarrheal character, one may allow barley jelly, and thoroughly boiled rice; later, toast, then an egg, then a chop and then gradually the resumption of a normal diet.

When, however, a case runs a chronic course, the same needs for sufficient foods to make good the body losses prevail as in typhoid fever. These will be taken up shortly.

All food should be given warm, for if cold or very hot, peristalsis is aggravated.

Water should be given freely, as it must be appreciated that there is a constant and great loss of water to the tissues. It should not be given too cold or in too large amounts at once, for reasons just expressed.

If, however, milk cannot be taken, one may use barley-water, rice-water, egg-albumin, thin chicken broth.

Milk sugar may be added to the foods given so as to increase the caloric value.

If there is much gastric disturbance, all foods must be stopped, until it is removed.

Care of the Bowels. As the treatment of the disease resolves itself pretty much into the treatment of the bowel, the preliminary catharsis only will be touched upon here and the rest taken up under symptomatic treatment.

The object of the **preliminary catharsis** is to clean out the intestinal canal as far as possible before beginning treatment. That the patient has diarrhea and frequent diarrhea is by no means proof that the intestine is clear. It is undoubtedly Nature's intent that it should be, and the diarrhea is but an expression of the intestine's effort to rid itself of irritation, which effort may be futile or abortive, without help.

There are three cathartics especially recommended for this purpose. Calomel, salines, and castor oil.

Personally, I am emphatically in favor of castor oil. I prefer it because I believe it as effectual as the others in evacuating the bowel;

because I believe it less irritating than the others and because I am convinced that it has an after-constipating effect.

A paper read at the American Pediatric Association by Abt of Chicago dealt with the study of the effects of repeated doses of these three cathartics in infants in doses usually used in diarrhea, with reference to irritating effects produced, as expressed by the presence of mucus and occult blood. After the second dose—the doses given at two hour intervals—calomel was followed by increasing amounts both of blood and mucus, salines by less and castor oil by least and but little unless in large and long continued doses.

I would not convey the impression that this occurs in the adult enough to decry their use, for I think that would be unfair.

If there is **nausea and vomiting** accompanying the attack, one gives **calomel in divided doses,** gr. ¼ or gr. ⅒ every ten or fifteen minutes until 1 or 1¼ gr. are given, for the anti-emetic effect of the drug as well as its cathartic; then, if the stomach is quiet, give the oil, or failing that, salts.

Castor Oil never was looked upon as a delicacy and the very sight or mention of it is so keenly associated in the minds of many with the ordeals of childhood that it is flatly refused or taken under bitter protest. Because of this fact, so-called tasteless preparations are offered or its taste is covered or it is given in capsules.

There are several **ways of giving castor oil** while at the same time disguising its taste, and this may be so successfully done at times, as to make it desirable to administer it without announcing its character. Many vehicles, however, like hot black coffee, sarsaparilla, soda or beer are unsuited to the conditions at hand, while to give it in milk is to violate a rule that cannot be too emphatically insisted upon —"never give disagreeable medicines in a food."

The disguise is not complete and the association may turn the patient against an important food.

An excellent method is to put a teaspoonful of brandy, whisky, wine, lemon-juice, orange-juice or peppermint water in a wine or egg glass, let it run all around the surface to wet it, pour on to that 5 teaspoonfuls of castor oil from a spoon previously wetted in hot water to let it run easily, over the oil another teaspoonful of the same substance, and instruct the patient to take it quickly, wiping the lips and allowing him to suck an orange or lemon.

The dose is, then, ½ to 1 ounce.

Specific Treatment. A specific serum was elaborated by Shiga, which in his hands gave very flattering results that have failed of confirmation. Flexner also prepared a serum which was used in a considerable series of cases of infantile dysentery, but with results that gave little encouragement.

Empirical Treatment. One drug in dysentery has given me more satisfaction than any other, and that is **castor oil.**

The following prescription advised by Dr. Francis Delafield of this city has been especially satisfactory:

℞—Olei ricini	10.	ʒiiss
Salol	2.50	gr. xxxvii
Tr. opii deodorati	1.	m. xv.

M. et Div. in capsulas no. xv.
S. One every two hours.

The results are truly most gratifying and I have had to have recourse to no other prescription in a large series of cases of dysentery, but that does not include the severest types described, or the tropical variety (amebic).

One capsule is given every two hours and when the stools begin to diminish materially, one every three hours and with still further improvement every four hours.

I believe the improvement is due to the small doses of oil, for the results are very satisfactory without the opium; and one may give the prescription without the opium in the milder cases and when the stools begin materially to decrease in number. The small dose of opium, equal to $\frac{1}{10}$ gr. (0.006 Gm) does, however, add its own effect and relieves the pain.

I am not convinced of any particular value on the part of salol. Perhaps it adds its own anodyne and antipyretic effect; any antiseptic virtue, I doubt.

There is one very **important adjuvant** to this treatment, also insisted upon by its advocate—namely, the administration every second day or at least every third day, of further large doses of castor oil as in the beginning.

The small doses are unquestionably constipating and the diminution of the stools is the result we see, as well as improvement in their character. We have to remember also that in the meantime fecal matter is collecting, mucus, bacterial toxins and bacteria themselves are gathering, and damage from these sources with a recrudescence of the disturbance will follow unless evacuation is attained at suitable periods.

Somewhat similar to this castor oil treatment is one warmly advocated in some quarters, but about which I can speak less authoritatively—namely, the **saline treatment.**

Sodium sulphate or magnesium sulphate is given in a half ounce or ounce dose, then followed by one dram doses of the salt every two hours, three hours or four hours as improvement occurs, or dram doses every hour can be given until the initial catharsis is accomplished.

Symptomatic Treatment.—Pain. Between the constantly recurring griping, twisting, colicky pains and the incessant nagging of the tenesmus, exhaustion threatens; so that the symptom is one of the most urgent in its demands for relief.

This may be afforded by **topical applications** or drug administration.

Heat to the abdomen is one of the best measures we have at our command. It can be applied in the shape of **hot fomentations, turpentine stupes** or **thin poultices.**

To give a **fomentation** take two pieces of thick flannel; an old blanket affords just the material we want, cut into squares to cover the abdomen.

Have ready in addition another piece of flannel for a cover or protector and a towel with sticks sewed across either end to answer as a wringer.

Lay the flannel squares in the towel, pour boiling water over them, saturating them thoroughly and then quickly wring out in the towel by twisting the sticks in opposite directions to each other. The wringing must be complete and no water be left in the flannel. Take this out quickly, shake it once in the air, place it on the abdomen and cover with the protector. Before the fomentations are applied, the skin may well be lubricated with vaseline.

It is helpful to have the patient in a blanket which can be brought up over the fomentations.

These may be applied every ten or fifteen minutes until relief is afforded.

Turpentine stupes are prepared in much the same way, a dram of turpentine having been added to the hot water into which the flannels are to be dipped or the stupes may be sprinkled with a little turpentine after they have been wrung out or a bit of absorbent cotton wet with turpentine may be passed lightly over the abdomen before the stupes are applied. Careless application of the turpentine may result in a burning of the skin.

The frequency of application and the length of time they are to be left on will depend on the reaction of the skin to the turpentine and the efficacy of the measure.

These devices not only lessen the spasm, but by so doing diminish the frequency of the stools.

Comfort may also be afforded by **warm rectal irrigations,** at 100° F. to 105° F. of plain water or, better, physiological salt solution, one teaspoonful (1 dram) of salt to the pint (4 Gm to 500 c.c.).

These irrigations are considered by some men as an important item in the treatment of the inflamed colon and are especially in vogue in children's practice. I have had to have recourse to them in adult practice, in the acute stage but rarely, finding the prescription given above together with fomentations sufficient.

While at times the irrigation does good, I prefer to do without it if possible, because it can be overdone and one feels that often when it is done, the bowel gets more excitation than rest by the procedure.

The **tenesmus** frequently requires **drug treatment** and we prefer to give it locally at first. This can be done by the suppository containing gr. ss (0.030 Gm) of **opium** or in more severe cases by the morphine suppository which contains gr. ¼ (0.015 Gm) or by one combining opium and belladonna, e.g.:

℞—Opii pulveris	gr. i (0.060 Gm)
Ext. belladonnæ fol.	gr. ¼ (0.015 Gm)
Olei theobromatis ....q.s.	(gr. xxx) (2 Gm)

M. et Fiant talia suppositoria no. xii.
S. One inserted as directed.

Another time-honored method of using opium by the rectum is through the medium of starch mucilage.

Give m. xv (1 c.c.) of the tincture of opium in an ounce or two of the starch preparation, injecting slowly. In an irritable bowel the smaller amount is more easily retained.

There are cases in which the pain is too great to be relieved by these efforts, and morphine has to be used hypodermically. When this is done, appreciate that a fight is on and the drug habit is the antagonist. Use it sparingly, both as to dose and periodicity, and take the evidences of pain rather than the assertion of the patient as the criterion of its usage.

Diarrhea. The stools of dysentery are characteristic. They are small, often not a teaspoonful at a time, and consist of little clots of mucus for the most part blood-stained, like soaked meat. It is evident that these stools no longer represent a conservative process, but are the simple expression of the inflammatory process. They test the limit of the patient's endurance. They have to be controlled or rather the bowel must get the rest that a diminution of the stools bespeaks.

Numerous **drugs** have been advised. They may be divided into three classes: Astringents, local sedatives, and opium.

I do not like the first. Astringents operate by inducing changes in the protoplasmic substance of the cells, that threaten their integrity. One feels that it is heaping Ossa upon Pelion in the acute process.

I pin my faith on the last two, and especially opium.

As to **bismuth**, its action is largely protective, though, perhaps, to some slight degree partaking of the astringent properties of all the heavy metals. If it is the purpose to coat over the mucous membrane with bismuth, or even if this theory of its action is not correct, still experience has shown that to do real good it has to be used in large doses. It is insoluble and non-toxic, which statements may stand good as far as they influence its therapeutic use.

It should be given in at least gr. xxx (2 Gm) doses every two hours until results are obtained. The easiest way to give it is in powders. A powder in a little water, a shake which diffuses it in suspension in a second, and take so.

One warning must be offered born of experience.

Be sure that at least every second or third day the bowel is emptied by a dose of castor oil or salts, for these large doses of bismuth collect in the bowel and by sheer weight do harm to the gut. One of my most vivid recollections is seeing a case to which bismuth had been given for weeks without catharsis and with the continuance of the symptoms to a point of dubious prognosis.

A large dose of oil was followed by movements that literally filled the bed-pan with black masses of bismuth that looked like fresh tar-concrete and must have weighed pounds. Recovery started from the time of this relief.

Upon **opium** we are dependent for our best results.

It diminishes peristalsis and so the cause of pain and tenesmus, it diminishes the stools, it lessens pain and permits rest and sleep; rest for the bowel, rest for the body and rest for the mind.

There are three things that should be emphasized about the use of opium in these cases:

1. Never use it until the bowel has been efficiently emptied by one of the cathartics advised.
2. Use it in the smallest amounts that will get results. I have rarely had to use it in greater amounts than 1/10 of a grain (0.006 Gm), that is one drop of the tincture every two hours.
3. Do not advise the patient of the fact that you are using it. The profound effects of opium that will permit him to appreciate that he is getting it will not be manifested in these doses.

Again the necessity of the cathartic at intervals of two or three days should be emphasized.

Duration. Most cases run a course of a few days to a week or a trifle more, a certain number continue three, four, five or six weeks and then cease or pass over into chronic form.

Subacute and Chronic Form. When a case is passing over into a chronic form, if seen for the first time, the effects of such medication as has been advised may be tried long enough to test its worth; if of no avail, make use of **topical measures** and give as little medicine as possible, especially avoiding opium on account of the danger of the habit.

In the chronic form the use of the irrigation is more valuable than in the acute.

There is one thing about the **irrigation** and the use of all topical measures to be insisted upon and that is, if used in the acute stage assiduously the chronicity of the process may be due to the irritation these very measures keep up, and a cessation of all local treatment be followed by rapid improvement. Again, when these methods are pursued in a chronic case, improvement may be seen up to a certain point and then cease or the condition grow worse. Here again stop the treatment and study the effect.

The irrigation is to be done with the patient in the dorsal position with the hips elevated and on a douche-pan, or lying across the bed on a rubber-sheet so arranged as to form a gutter for the discharge of water.

Sometimes the bowel is better filled by putting the patient on his left side and then turning him to his right, so as to seek the assistance of gravity in following the line of the colon.

If the patient is fairly strong, the more trying knee-chest or elbow position may be used.

The tube should be long and soft, a rectal tube, a stomach siphon or a large rubber catheter will answer.

The tube is warmed, lubricated and passed carefully into the bowel, as any roughness will cause a contraction and defeat the purpose. If it meets with an obstruction, wait until a spasm ceases and then try again. If difficulty is met with let a little water pass in to distend the gut and try again. Pass it in 4 or 5 inches.

The tube is then or has previously been attached to a Y tube, to the other two limbs of which are attached the fountain syringe and the drainage tube. The bag contains for a simple irrigation plain water or better a physiological salt solution, a level teaspoonful of salt to the pint, at a temperature of 100° F. It should be held about three feet above the level of the patient's body. The water is allowed to flow in and out, by alternatingly pinching the outflow tube and the inflow tube. Discomfort on the part of the patient tells when enough has been introduced at any one time.

If irrigation of the lower part of the intestine alone is aimed at, a two-way tube like the Kemp tube is a great convenience.

About two quarts may be used at a time; in some cases, even more.

The irrigation may be followed by an astringent.

The best astringent is **silver nitrate.** It should be used in increasing strengths, 1 to 2,000 at first and increasing up to 1 in 500 or 1 in 400 or 300.

Use one or two pints. It may be introduced through the same syringe and tube. The tube should be pinched to keep the solution in contact with the bowel a few minutes or left in for the patient to pass.

If salt solution is used at first, it must all be discharged or the silver will be neutralized by it.

In this case, if such difficulty is constantly met with, use plain water. If the solution of silver gives great pain it is too strong and may be neutralized by salt solution.

The treatment may be tried daily in the weaker solutions and then less frequently. Intermit the treatment occasionally to let the mucous membrane recover from any irritation by the silver that might have been excessive.

These protracted cases are often due to **ulcers** which will not heal under this milder application; hence, an effort should be made by the aid of the proctoscope or sigmoidoscope to detect and treat directly any ulcer within reach. Here **strong silver** in 25 per cent. solution or the stick may be used.

There are two other important matters to be taken into consideration in the treatment of chronic dysentery—namely, change in environment and the diet.

Change in Environment. What those subtle influences are that determine improvement in a new environment, seen in those patients fighting to overcome a lingering infection of one kind or another, defies analysis at present.

While climate, fresh air, sunlight and other physical conditions may be appealed to, they are not always sufficient. The effect upon the mind induced by a change certainly has something to do with the results. I recall a bitter struggle with dysentery, occurring in a patient attacked away from home, dragging out to eight or ten weeks in whom the home-going, though effected on a stretcher, brought health and strength in a manner little short of the miraculous, and such examples every practitioner of medicine can recall.

Diet in the prolonged or chronic cases is an important problem. During the progress of this disease the patient loses much flesh, to which the low diet adopted to spare the inflamed bowel, has been a factor.

Loss of body substance in infectious diseases is due to (1) pyrexia, (2) toxemia, and (3) starvation. Now, in these prolonged cases the fever has waned and the signs of general toxemia, other than the residual weakness, have subsided, and because the patient has still too many loose stools with mucus, he is kept on the same restricted diet.

The diet is milk, perhaps two quarts of it with about 1,280 calories and 70 grms. of proteid. Now how can a man, whose daily needs are well over 2,000 calories, make up 1,000 deficit out of his own tissues day after day and still afford energy enough for successful resistance and repair? The proposition is absurd, and I am convinced that in a large percentage of these cases that drag along, starvation is at the bottom of it.

I look through dietary after dietary and see milk, cautiously a little egg and still more cautiously a little scraped meat offered, and no mention made of the use to which the carbohydrates could be put. I do not think we should be alarmed at the addition of a little sugar to the milk, and, if we fear fermentation, we can add milk-sugar which is not easily fermentable. Every ounce is worth 120 calories and we could add three ounces to the two quarts of milk without provoking trouble or even distaste.

The cereals should be used—barley, rice, farina, bread and butter, cereal soups; eggs may be given, each worth 60 to 70 calories. A small chop is easily digested and modern physiology emphasizes how easily proteid is digested and assimilated and there are 100 calories more.

Beef, mutton, chicken, and potatoes leave but little residue, and if the patient does well on this more liberal diet, give him some of the green vegetables, puréed at first—peas, or small stringed beans—and let us see if they do not improve rather than aggravate the condition.

What should be emphasized is that the body may suffer more from the absence of food than the intestine from its presence. That when the acuteness of the process has subsided, one should consider the dietetic need of the patient, and see that he gets it, at first in food that leaves but little residue, and then permitting other foods little by little. We are humiliated sometimes to find that these chronic cases improve when first they escape our hands.

Prophylaxis. The bacillus seems to be water-borne, and so when an epidemic occurs the same precautions should be taken as in that other water-borne infection—typhoid fever. Water should be boiled, milk inspected or boiled, green vegetables thoroughly cleaned. Infection, too, may come from contact, and the stools should be destroyed and clothes treated in the same manner as in typhoid.

Especial care should be taken by nurses handling infants lest the infection be carried by handling soiled linen.

Flies are carriers and should be kept from the sick room by screens.

SUMMARY

Bacillary Dysentery

Rest.
- In bed.

Bed.
- Half bed; hospital type best.
- Woven wire springs.
- Hair mattress.
- Rubber sheet.
- Draw sheet.
- Sheets; light blanket; low pillow.

Room.
- Well ventilated; shaded balcony; adjacent bath-room.

Care of the body.
- Bath.
- Castile soap and warm water daily.
- Alcohol rubs, especially over points of pressure in emaciated cases.
- Talcum or other drying powders.
- Mouth.
  - Rinse after every feeding; use boric acid solution 2–4 per cent. strength. Dobell's Solution.
  - Teeth brushed twice a day.

Interstices of teeth freed from food particles. Use small cotton swabs on wooden tooth-picks as applicators.

Tongue.

Soften coat with one-half strength peroxide of hydrogen.

Cleanse with boric acid solution or Dobell's.

Dry mouth.

Equal parts of 2 per cent. boric acid solution and abolene flavored with lemon juice.

Points of pressure—threatened bed sores. Change of position; rubbing; rubber rings; air cushions.

Exclude visitors.

Use of bed-pan imperative. (Technique, see text.)

Woolen material over abdomen.

Diet.

Boiled milk, diluted ½ to ⅓ or ¼ with plain water, barley water or rice water.

8 ounces every two hours.

Next add milk sugar ½ ounce to 1 ounce to each glass to increase calories.

If there is gastric distress, flatulency, coated tongue or curds in stools, skim the milk or cut out sugar or both. If marked, stop all food for a time.

If milk is not well borne use barley water, rice water, arrowroot water, egg-albumin, thin chicken broth (free from fat) mutton broth (free from fat). Gradually thicken the cereal waters and boil them into the broths. Add milk-sugar to the cereal waters. Add toast.

All food should be given warm, not hot or cold.

When temperature is normal and stools take on substance, add boiled rice, then toast, then chop, then puréed vegetables and then normal diet.

Water should be given freely throughout; administered with the chill taken off.

Care of the bowels.

Preliminary catharsis.

Castor oil ℥ss–i (15–30 c.c.) best; or salts, Epsom preferred, ℥ss–i (15–30 Gm).

If there is nausea or vomiting, calomel, gr. ¼ or ⅒ (0.015–0.006 Gm) at fifteen or ten minute intervals until gr. i to gr. iss (0.060-0.10 Gm) be given (acts as an antiemetic as well as a cathartic).

Follow in two or three hours by castor oil or salts, as above.

How to disguise castor oil. (See text.)

Specific treatment.

Not much promise except perhaps in Shiga (epidemic) type.

Empirical treatment.

Castor oil in small doses frequently and in large doses at intervals.

℞

Olei ricini	10.00	ʒiiss
Salol	2.50	gr. xxxvii
Tr. opii deodorati	1.00	m. xv

M. et Div. in capsulas no. xv.

One every two hours; with improvement every three hours; then every four hours.
If of mild grade leave out opium.
Every second day castor oil ℥ss–i (15–30 c.c.).

Saline treatment.

Magnesium sulphate (Epsom salts) or sodium sulphate (Glauber's salts) ℥ss–i (15–30 Gm); follow by ʒi 4 Gm doses every two hours; then as improvement occurs three and four hours.

Symptomatic Treatment.

Pain—colic.

Topical applications.

Heat.
  Fomentations. (Technique, see text.)
  Turpentine stupes. (Technique, see text.)
  Thin poultices. (Technique, see Pneumonia, Chap. IV.)
Rectal irrigations of plain water in salt solutions (ʒi–Oi) (4 Gm to 500 c.c.) at 100° F. to 105° F.
Drugs, when severe.
  Morphine hypodermically, least quantity effectual, gr. $\frac{1}{16}$ to gr. $\frac{1}{4}$ (0.004–0.015 Gm).

Tenesmus.

Warm rectal irrigations as above for pain.
Suppositories of opium, gr. ss (0.030).
or

℞

Opii pulveris	gr. i	(0.065)
Ext. Belladonnæ fol.	gr. $\frac{1}{4}$	(0.015)
Olii theobromatis	q.s. (gr. xxx)	(2.00)

M. et Fiant talia suppositoria no. xii.
S. Insert one as directed.

Rectal injections of opium in starch paste.
  Tr. opii m. xv (1 c.c.) in ℥j–ii (30–60 c.c.) starch mucilage and inject slowly.
Morphine, gr. $\frac{1}{16}$ (0.004 Gm) to gr. $\frac{1}{4}$ (0.015 Gm) Hypodermically.

Diarrhea.

Usually satisfactorily controlled by the small doses of castor oil and salol as described above under empirical treatment.
Bismuth.
  Bismuth subnitrate, gr. xxx (2 Gm) every two hours. Adminis-

tered in a little water; a shake diffuses the powder throughout the liquid evenly.

- Every second or third day give castor oil (preferably) or salts, ℥ss–i (15–30 Gm).
- Opium.
  - As given with castor oil and salol, as above, under empirical treatment, it is usually sufficient. If not, increase the opium or give it with the bismuth.
    1. Never use opium until the bowel is emptied by oil or salts.
    2. Use it in smallest quantities that are effectual.
    3. Do not advise the patient of its use.
- Subacute and chronic stages.
  - Irrigations.
    - Technique. (See text.)
    - Plain water or salt solution first; then silver nitrate, at first 1–2000, gradually increasing up to 1–500 or, stronger, 1–300.
    - Use 1 or 2 pints at 100° F.
    - If it causes pain neutralize the silver in the bowel by an enema of salt solution (ʒi–Oi) (4 Gm–500 c.c.).
    - Frequency; daily in weaker solution, less frequently with stronger.
    - Intermit occasionally, as irritation of astringents may be cause of continued diarrhea.

Ulcers.

- Often the cause of protracted cases. Use protoscope or sigmoidoscope to detect ulcer and apply medication. Apply 25 per cent. solution of silver nitrate or the silver stick.
- Change of environment.

Diet.

- Increased to meet caloric demands. (See Diet in Acute Infectious Diseases, Chap. II.)
- If on milk add milk sugar ℥ss–i (15–30 Gm) to each glass (℥viii) (240 c.c.), and then cereals, barley, farina, then rice, bread and butter, cereal soups, then mutton and chicken broth with rice, barley, arrowroot, or flour to thicken; then eggs, chop, chicken, potatoes, peas and beans (at first puréed) and even a more liberal diet.

Prophylaxis.

- Bacillus seems to be water-borne.
- Take same precautions in an epidemic as in a typhoid epidemic.
- Boil water.
- Drink only "inspected" or boiled milk.
- Thoroughly cleanse all green vegetables or exclude them from diet.
- Disinfect stools. (See Typhoid Fever, Chap. V.)
- Disinfect articles. (See Typhoid Fever, Chap. V.)
- Disinfect hands after handling patients and excretions.
- Screen room from flies.

AMEBIC DYSENTERY

While the severity of a dysenteric process, the locality in which it was contracted (tropical and sub-tropical countries) and its prolonged course makes the diagnosis of amebic dysentery more than probable and the hepatitis makes it certain, still, and, especially, in temperate zones, only the recovery of the specific organisms from the stool can make the diagnosis certain in the overwhelming majority of cases.

The specific organism is the **Entamœba histolytica.**

There is another entamœba, for a long time undifferentiated from histolytica and so credited with causation of the disease.

It is the entamœba coli and as this occurs in the stools of a goodly percentage of normal men and so in the stools of many cases of bacillary dysentery, it is a matter of importance to differentiate them; the more so as the treatment most efficacious in Amebic dysentery has no effect on the progress of bacillary dysentery, and, *vice versa,* the treatment described for bacillary dysentery does not affect the Entamœba histolytica at all.

When, however, this differentiation by finding an entamœba and identifying it is impossible one must rely on the criteria mentioned and when in doubt give the patient the benefit of the doubt and direct the treatment as in amebic dysentery; as the emetin will do no harm if no good.

Moreover, I do not know any reason why the empiric treatment given under bacillary dysentery should not be combined with the emetin treatment in a doubtful case.

All the rules laid down for the conservation of the patient's forces and for his comfort obtain in the one form of dysentery as in the other.

For the accomplishment of **rest,** the **choice** and **preparation** of the **bed** and the **room,** the **care of the body** in all its details and the **diet** the reader is referred to the first section of this chapter, Bacillary Dysentery.

As regards the diet, however, the severity and the prolonged course of amebic dysentery make the plea for sufficiency more emphatic, so that with boiling of milk or elimination of it when not well borne, the rules for diet laid down under Typhoid Fever (see Chap. V) should be a good guide.

The **care of the bowels** and the importance of the preliminary catharsis obtain in the one as in the other with equal force.

Empirical Treatment. Very recently a treatment has come into vogue that promises to be as nearly specific in this disease as quinine is in malaria and yet it is the offspring of an older, I might say "traditional" treatment in some parts of the world. This older treatment rested on the use of ipecac and the more recent on one of its active principles, **emetin.**

Ipecac had impressed many men practicing in India and elsewhere in the tropics as without a peer in its curative effects in Tropical Dysentery while others found it uncertain or disappointing. We know now that this discrepancy was due to the varying amounts of emetin in the ipecac used, as well, perhaps, as to the difficulties in assuring a sufficient absorption of this drug so actively emetic.

Within a very few years there has been a revival in the ipecac treatment of dysentery and the results reported were encouraging. The drug was given in pill form coated with salol to make it insoluble in the stomach. The instructions of Brown and Zeiler for its use are as follows: Use a salol coating 1/16 inch for the pills (thicker coating may make it too resistant and the pill passes in the stool intact; thinner coating disintegrates in the stomach).

They begin with 60–80 grains (4–5.30 Gm) taken at bed-time and decrease the dose 5 grains (0.30 Gm) a day until a dose of 10 grains (0.60 Gm) is reached.

The patient should be at rest in bed and no solid food or milk be given for at least six hours previous. No opiate, they say, is necessary.

The action of emetin is so much more certain and satisfactory that the only justification for the use of ipecac is the inability to get emetin.

Emetin Treatment. Of the active principles of ipecac emetin is found to be the one, and only one, that is amebicidal; while that action that gave to it its name, i.e., the emetic, does not belong to it at all, but to another active principle, cephaëlin.

The credit for the use of emetin in amebic dysentery is due to Rogers, an English physician.

While one could wish a larger body of statistics to justify such unqualified praise as is bestowed on this treatment, still such results as are accruing to its usage urge us to unhesitatingly recommend it.

Vedder has recently reported 110 cases with 99 clinical cures; that is, the disappearance of all dysenteric symptoms and the reappearance of a normal formed stool.

Amid the gropings after the best dosage and intervals of administrations, I shall choose Vedder's as at present the most satisfactory.

One may use either of the two salts of emetin, the hydrobromid or the hydrochlorid, but the latter is the more soluble and so preferable for hypodermic use.

The dose is gr. 1/3 (0.020 Gm), hypodermically, three times a day for ten days.

If at the end of this time the case seems clinically cured, the treatment is discontinued. If not increase the dose.

The cure is very rapid, often within the week, affording a striking contrast to the prolonged course of the disease under the old therapeusis. There is no vomiting or discomfort with this dose of the drug.

The most convincing proof of the specific effect of the drug upon the entamœba histolytica is the results in the cases complicated by **Hepatitis, hepatic abscess.**

Of sixteen cases reported 100 per cent. were cured. Remembering the mortality of these cases set by different observers at figures varying from 30 per cent. to 80 per cent. and that the best surgical results can not boast of better figures than 25 per cent. mortality, one does not wonder at the enthusiasm that led Vedder to say that "any amebic patient who is not moribund can be cured by emetin."

The **dose of emetin in liver abscess and mode of administration** and intervals is the same as in the uncomplicated dysentery.

The amœbæ are killed, but what pus has already been formed must be evacuated, and the cavity drained; but as the cause for suppuration is removed the discharge ceases, the wound heals and the cure is effected.

In cases clinically cured the amœbæ do not always disappear from the stools; that is, they become "carriers" and as such are a menace to the community.

In some of these cases there occur

Relapses. A relapse is to be treated as the original attack by a repetition of the series of emetin.

Quinine Treatment. A few months ago Brook of the Army reported on most gratifying results following the use of quinine given by mouth.

He called attention to the known amebicidal effects of solution of quinine and attributed its failure when given by the rectum to its inability to reach the organism in the tissues.

His dosage is gr. xxii–xxx (1.5–2 Gm) a day for six days.

He stops a week and then repeats the series; especially in chronic cases.

He believes that the special field of quinine is in chronic cases and those that relapse after emetin. He, too, believes that emetin is a specific in acute cases, but not as certain in the chronic, while in all cases he believes quinine in 2 Gm doses (gr. xxx) per day to be as efficient as ipecac.

Carriers. If emetin is so decided in its toxic effect on the entamœbæ it would seem logical to bring it into direct contact with the organisms in the stools in the case of carriers but emetin in any dilution has proven too irritating to the intestine to make its use feasible.

High irrigations of **silver nitrate** and of **quinine** have been found efficient.

Silver nitrate may be used as in bacillary dysentery in strength of 1 to 2,000 up to 1 to 500 or even 300.

Quinine solutions, on which the hopes of the therapeutists was once placed, while unable to reach the amœbæ in the tissues, can reach them and kill them in the stools and afford a means of attacking the carrier cases.

The solution should be from 1 to 2,000, up to 1 to 500.

Surgery. Since the introduction of emetin the surgical procedure in the liver is a matter of far less magnitude, while the operations on the bowel, such as appendicostomy for colonic irrigations are rarely indicated.

Prophylaxis. With the knowledge that infection comes through the ingesta, boiling of all water and cooking of all foods, together with disinfection of the excreta and scrupulous cleanliness in the handling of the same constitutes prophylaxis.

SUMMARY

Amebic Dysentery

Rest.
Bed.
Room.
Care of the body.

(See Bacillary Dysentery above.)

Diet.

(See Bacillary Dysentery and in prolonged cases see Typhoid Fever.)

Care of the bowels.
Preliminary catharsis.

(See Bacillary Dysentery above.)

Empirical treatment.

Emetin hydrochloride (or hydrobromide).
Dose, gr. ⅓ (0.20 Gm) three times a day for ten days.
Mode of administration, hypodermically.
If at the end of this time the case seems clinically cured stop treatment.
If at the end of this time the case does not seem clinically cured, increase the dose to gr. ½ (0.030 Gm).
When emetin is not procurable use the ipecac treatment.
Dose 60 to 80 grains (4–5.30 Gm) a day, taken in single dose at bed-time and decrease the dose gr. iv (0.33 Gm) each day until a dose of gr. x (0.66 Gm) is reached.
Mode of administration, by mouth in gr. v (0.33 Gm), pills coated with salol, 1/16 inch thick.
Patient at rest in bed and no solid food or milk given for at least six hours previously (no opiate necessary).

Quinine treatment of Brook.

Dose, gr. xxii–xxx (1.50–2 Gm) a day for six days.
Stop a week, then repeat the series.

Hepatitis—Liver abscess.

Emetin.

Dosage and administration same as in uncomplicated dysentery. (See above.)

Abscess aspirated or incised and drained.

Relapses.

Treated by emetin in the same way as the initial attack.

Brook claims quinine (as above) to be more efficacious than emetin in relapses.

Symptomatic Treatment.

Pain and colic. Tenesmus. Diarrhea.	(See Bacillary Dysentery above.)

Sub-acute and chronic stages with ulceration.

Silver nitrate. (See Bacillary Dysentery above.)

Solutions of quinine by the bowel. 1–2000 up to 1–1000.

Diet in chronic cases.

(See Bacillary Dysentery above and Typhoid Fever, Chap. V.)

Carriers.

Colon irrigations of silver nitrate 1–2,000 up to 1–300, increasing rapidly if the bowel shows toleration.

Irrigations with quinine solution, 1–1,000 up to 1–500.

Prophylaxis.

Boiling of drinking water.
Cooking of all foods.
Disinfection of excreta.
Cleanliness of hands.

CHAPTER VIII

THE TREATMENT OF GRIP OR INFLUENZA

Of grip or influenza there are two statements to be made which I think no one will attempt to gainsay; first, that of all the acute infectious diseases with which we have to deal, it is the most common; secondly, that no other acute infectious disease is so protean in its manifestations as this ubiquitous malady.

Much confusion has arisen in the use of these two terms, grip and influenza. By most men they are used synonymously, but many insist that influenza is applicable only to that infection caused by the organism of Pfeiffer, the influenza bacillus. If their contention is sustained, then we see this disease relatively infrequently, and what we consider as such and treat as such should receive another appellation and "grip" might be so used. Now, we do have a common clinical entity, characterized by suddenness of onset, aching pains in the back and limbs, headache, high fever, prostration, some catarrhal symptoms in the respiratory tract and followed by weakness and depression out of proportion to the other symptoms and which may be accompanied or followed by serious involvement of important organs or systems. These attacks are accompanied by the presence of one or the other or of a combination of several organisms, in such numbers and so distributed as to warrant the supposition that they stand in causal relationship to the disease; and among these organisms is the bacillus of Pfeiffer, but in by no means the majority of the cases. Beside this organism may be found the pneumococcus, the streptococcus pyogenes, the streptococcus mucosus capsulatus or the micrococcus catarrhalis. In no way does the attack, with reference to the onset, characteristic pains and aches, prostration, after effects or complications, differ in one case or another sufficiently to guarantee a diagnosis of the organism concerned. Moreover, the influenza bacillus has been found in other conditions that do not present the clinical picture of grip. Whether we are dealing with one or the other bacterium can be determined only by culture. At the present we have no specific treatment for influenza and find ourselves limited to the effort to afford relief, to prevent complications, or treat them if they do occur.

Therapy. All that follows, then, is applicable to the clinical grip and if I use both terms, it will be understood that they are used synonymously.

Rest. An attack of grip of average severity compels a patient to seek rest and seek it in **bed**; but in lesser attacks, often termed common colds—and, indeed, the border line between the common cold and grip is by no means clear cut—the patient may insist on keeping about and endeavor to attend to his business. That every patient with a cold in the head should go to bed is absurd, but if the so-called cold is accompanied by signs of intoxication, aches, pains, prostration and temperature out of proportion to the local manifestations, then the diagnosis is warranted, as at least connoting a more serious infection, of which the complications or sequelæ are to be feared, and the patient should be ordered to bed until his temperature is normal, his protests being met by a presentation of the facts and possibilities in the case.

The typical attack of influenza is usually abrupt, sometimes like a bolt out of the blue, ushered in with chilly sensations and decided malaise.

The patient should be put to bed, a hot water bag put at his feet, a drink of hot tea, hot water and a teaspoonful or two of whiskey or a hot lemonade with or without whiskey given, and blankets added to the covering until the febrile reaction begins. With the fever comes the headache, the pains in the back and bones that makes the patient feel as if he had been mauled and bruised, and the discomforts of the elevated temperature. The head is often confused and a mild delirium may occur.

A cool **sponge bath** or one with tepid water or one containing a little alcohol applied to the whole body or to the face, arms and legs gives some relief. Cold cloths are placed on the forehead to relieve the headache or an ice-bag may be used. Bits of cracked ice are sucked or small amounts of cold water taken frequently.

A **saline cathartic** should be given, in the shape of a **Seidlitz powder,** a full glass of **liquor magnesii citratis,** or a half ounce of either **Rochelle salts** or **Epsom salts** in a half to three-fourths of a glass of water.

Diet. At the onset of the attack food should not be offered; and the anorexia should be taken as an indication that the body is not ready to entertain it. After the first day, however, fluids in the shape of milk or gruels may be given and later soups, eggs, and cereals.

When the temperature has subsided the diet should be made liberal, for the loss of flesh may have been considerable, and it must be appreciated that the 2,500 or more calories that the body will have, even in the weakened state, must come from somewhere, out of its own tissue, if not provided for in its food.

SYMPTOMATIC TREATMENT

Sthenic Period of Toxæmia.—Drugs. In no other acute infectious disorder do the coal tars work so happily to the comfort of the patient, as in this.

The sudden fever, the severe headache and the racking pains of body and limbs all indicate these antipyretics and analgesics.

There is no class of drugs more abused or misused than the antipyretics. In a certain number of conditions when properly used they are invaluable, but like most drugs of real worth they are rife with danger when administered carelessly or in ignorance.

The three best known **antipyretics** are **acetanilid,** sometimes called antifebrin, **antipyrin** and **phenacetin.**

This is also the order of their potency and of their toxicity. From these three have come numerous derivatives, made by introducing a radicle into their structure or substituting one radicle for another, in the effort to enhance their pharmacological value and at the same time diminish their dangers. With them have been combined other drugs of a different pharmacological action in the effort to get the two in one preparation, as for example when antipyrin and chloral are combined to form hypnal to get a substance which will produce sleep in the presence of pain, or salicylic acid and antipyrin are combined to form salipyrin to enhance the value of salicylic acid in the relief of pain in rheumatism.

So quickly and abundantly have these preparations come, so ardently have they been welcomed and praised, so rapidly have they been abandoned that it is difficult to set an appreciation on more than a few of the group.

Personally, I rarely use for any purpose any other than the three first mentioned.

In grip any one may be used; better results are obtained from small doses frequently given than from large doses. Which of these is the better I cannot say, but one will find oneself giving preference to one or the other more and more and that will represent the reliance that comes with familiarity.

In grip my preference is for the most toxic and potent of these three—namely, **acetanilid,** but I give it in small quantities at frequent intervals.

The results have been so good, year in and year out, that I have felt no inclination to experiment with the others.

I have no doubt that I should have had just as good reports to offer from one of the other preparations had I accustomed myself to their usage. My favorite prescription runs thus:—

℞—Acetanilidi	1.50	gr. xxiiss.
Sodii bicarbonatis	1.00	gr. xv.
Caffeinæ citratæ	.50	gr. viiss.

M. et Divide in capsulas no. xv.

Each of these capsules, then, contains 1½ grains (0.10 Gm) of acetanilid, which is a very small dose, one grain of bicarbonate of soda, which possibly lessens the slight irritant effect of acetanilid on the gastric mucous membrane; at any rate it is given on that supposition, and ½ grain (0.030 Gm) of citrated caffeine, for two reasons: First, as a prophylactic, to counteract the slight depressing effect that is induced in some susceptible individuals by acetanilid, and secondly, because it is itself an analgesic.

The fact that caffeine is a circulatory stimulant naturally led to the supposition that its presence in a prescription containing acetanilid or other antipyretic afforded an antidote in some measure to the toxic effects of the latter. Physicians have been influenced by this idea to permit patients to take doses of these antipyretics, when so "sheltered," of a size they would fear to administer, if given alone.

Worth Hale[1] experimenting on the toxicity of acetanilid when administered alone, when given with caffeine, with sodium bicarbonate or when all three are combined, obtained results that make us pause in the use of the larger doses of these drugs.

In animals he could show that the addition of caffeine to acetanilid caused death by the latter more quickly or in smaller dose, while bicarbonate lessened the toxicity of acetanilid.

In white mice he found acetanilid and sodium bicarbonate the least poisonous, acetanilid alone next, acetanilid, caffeine, and sodium bicarbonate still more, and acetanilid and caffeine most.

I give this capsule, if the attack is severe, every hour for four doses, then every two hours, so that, the patient gets only 10 grains (0.60 Gm) in ten hours, a dose set down in some of the books as a single dose, though I think it rather large.

In the vast majority of cases the effects are very manifest in terms of relief from discomfort within a very few doses and this is followed soon by a fall in temperature, which is usually marked by, if not before, the next morning.

If such relief occurs, one may give the capsule the next day at three hour intervals and the next at four hour intervals. In the lighter attacks the drug need not be continued beyond the next day. If the attack is prolonged or complications ensue, the drug should not be too long continued. Such continued usage will do harm. Its benefit is confined to the early, sthenic period of the infection.

This is very important to remember, for one must not entertain the idea for a moment that these drugs cure the disease or have any direct action on the invading organism. They simply make the patient more comfortable and in better condition to meet the infection.

The effects of these drugs on fever is rather interesting, and, indeed, we need once in a while to orientate ourselves with reference to our ideas of fever.

Fever, after all, is a state or condition in which the bodily processes operate at a higher bodily temperature. This state may be variously brought about; but here, as in most of the fevers in which we are interested, it is brought about by the action of the toxins of the infecting organisms on the heat regulating mechanism. We often speak of the patient as "burning up with fever" and entertain the idea that his combustion, his oxidation processes, are greatly increased.

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[1] Worth Hale: The Effects of Caffeine and Sodium Bicarbonate upon the Toxicity of Acetanilid. *The Journal of Pharmacology and Experimental Therapeutics,* Vol. I, No. 2.

This is not the case. The actual increase in oxidation is slight. While varying in different diseases and individuals, the amount of increase will not average over 25 per cent. of the heat production at rest and as compared with the output of heat during active exercise is a mere bagatelle.

A man at rest with food eliminated 812 grams of CO_2 in the day and a man at severe work 3,073 grams of CO_2: over three and a half times as much, and yet all the heat this oxidation represents induced no fever.

Nor, on the other hand, is the output of heat greatly interfered with to account for fever.

What seems actually to occur is that the heat regulation has been set at a higher level, runs on a different plane.

But on this plane the same mechanism for retaining heat when the body temperature is lowered and the same mechanism for getting rid of heat when the body temperature is raised is called into action as when running at a normal level. At this new level, however, the mechanism is not so nicely adjusted and greater variations follow from lesser influences exerted on it; hence, the marked effect of antipyretics in fever that we do not see follow in conditions of health.

This regulating mechanism is vested in special nerve-tissue somewhere at the base of the cerebrum, in the neighborhood of the corpus striatum.

How antipyretics act on this centre we do not know, but what they do is to knock the regulation down to a lower level, on which the mechanisms of defence against an increase or decrease of heat are called into action, just as on the higher plane before the administration of the drug and as on the lower plane in health.

But as the influence of the drug wears off or the influence of the toxin reasserts itself, the heat regulation is pitched higher and higher to its old level.

We know that the fever is not the disease, only a symptom.

We know that temperature above 102° F. is accompanied by increased proteid destruction, which it may or may not be desirable to interfere with.

We know that the temperature may become so high as to threaten life itself and then certainly should be combated; but we are coming more and more to scrutinize symptoms so as to detect in them expressions of compensatory processes.

That fever was a favorable state in the presence of the toxemia of infection was an idea long entertained, more lately fell into disrepute and, now, most recently, is being advocated by thoughtful men and careful observers.

What our antipyretics do of value in grip is probably less attributable to the lowering of temperature than to the relief of aches, pains, cerebral excitement, all of which mean wear and tear, and so, as I have said, make the patient better able to cope with the infection.

Acetanilid is chemically a very simple body.

It is derived from anilin, $C_6H_5NH_2$. It was discovered that anilin had the property of lowering temperature but that it was at the same time very toxic, inducing collapse.

I have shown how the toxicity of a drug may be altered by the introduction of simple radicles into its constitution without altering its efficiency from a therapeutic standpoint, when discussing the salicylates in the treatment of rheumatism.[1]

Now the introduction of an alkyl radicle to replace an H of an amido group retards the action of the base, so when the acetic acid radicle CH_3CO- takes the place of an H in the amido group of analin, C_6H_5NH (CH_3CO), it retards the action of the active portion of the molecule which is anilin when it is set free, and it does that by offering resistance to the oxidative processes of the organism, by which the setting free of the anilin occurs. The result is a partial detoxication of the anilin. When the anilin is set free the body further oxidizes it to a paramidophenol, which is analin with an OH radical taking the place of the H in the ring opposite the NH_2 group, the para position. This oxidation further detoxicates the substance and when finally it becomes paired with sulphuric acid or glycuronic acid the detoxication is complete and the substance is so eliminated in the urine.

CNH_2 HC CH HC CH C H	H $CNCH_3CO$ HC CH HC CH C H	CNH_2 HC CH HC CH C OH	$CNCH_3CO$ HC CH HC CH C OC_2H_5
1	2	3	4

1. Aniline.
2. Acetanilid in which one of the H molecules in the amido group has been replaced by the alkyl radicle CH_3CO.
3. Paramidophenol, in which an H molecule in the opposite group (para position) has been replaced by an OH radicle.
4. Phenacetin, in which the H molecule of the para position of acetanilid has been replaced by an oxyethyl group O_2CH_3.

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[1] See *Treatment of Rheumatic Fever,* Chap. III.

When the chemists appreciated the means by which Nature detoxicated acetanilid, they seized on the paramidophenol, which while less poisonous than anilin was still capable of inducing symptoms in kind and of still changing hemoglobin into methemoglobin like the mother substance and rendered it less toxic by introducing an ethyl radicle into the OH in the para position and thus produced a body which permitted the paramidophenol to be set free from its molecule still more slowly and therefore was less toxic. The characteristic action, being all the time due to the paramidophenol.

This body is known as phenacetin $C_{10}H_{12}NO_2$. One sees then that phenacetin is acetanilid in which the H of the para position is replaced by an oxyethyl group.

So it is with all this group of drugs. They all owe their activity to the setting free of the paramidophenol, but their efficiency and safety to a nicety of balance between "fast enough" to have action on the tissue and "slow enough" not to poison the tissue.

So in administering these drugs, the amounts and frequencies with which they are administered make a great difference in the ultimate results.

If one entertains prejudices against acetanilid, one may use the less toxic **phenacetin** in its place in such a prescription as I have just given in doses of gr. ii to iiss (0.125–0.150 Gm); or it may be used alone, as the use of the other constituents in this case obtain to a less degree.

Toxic Effects. If these antipyretics be used injudiciously in large amounts or in cases of idiosyncrasy for the drug, certain untoward results may ensue. They are the onset of (1) collapse, (2) cyanosis, (3) a group of lesser disorders.

(1) The **collapse** may come on abruptly or after certain premonitory symptoms. It is more likely to ensue with acetanilid than with the others and with antipyrin more commonly than with phenacetin.

The patient is pale, the skin cold and clammy, the pulse rapid, small and sometimes irregular, the pupils slightly dilated and the patient faint, apathetic or confused. He may remain, however, perfectly conscious. The treatment like that of collapse from any cause is, in brief, application of heat and stimulation.

(2) **Cyanosis.** A marked degree of cyanosis is a characteristic symptom of poisoning by these drugs and is most marked after acetanilid, less after phenacetin and least after antipyrin.

It occurs early relative to the more dangerous symptoms and it is not an uncommon experience to see patients who use this class of drugs freely for headache and neuralgias, especially in the shape of some of the proprietary remedies, with blue lips and finger nails, though not conscious of further distress.

The cyanosis is not an indication of respiratory or circulatory embarrassment, but is due to changes in the coloring matter of the blood, to the formation of methemoglobin. Of course, if the dose is sufficiently large, dyspnea and cardiac failure ensue.

(3) Among the **lesser disorders** that occasionally appear are **eruptions,** erythemata, urticaria, or even angioneurotic edema. There may be **burning of throat or mouth, nausea or vomiting, excessive perspiration,** more rarely **apathy** or **mental confusion** or **disturbances of hearing.**

The eruptions may give rise to a diagnosis of scarlet fever or measles. In the former case the sudden onset and other symptoms may easily be diagnosed as grip and the coal tars given in treatment.

With the appearance of the eruption one might attribute it to the coal tars. Take no chances in the matter. Treat it as scarlet fever until proven to the contrary. When one has to differentiate between two conditions, one of which is common, and the other unusual, one should always give preference to the former. One should not let the possibility of a shrewd diagnosis run away with sober sense.

By enumerating all the things that may occur after the use of the coal tars, I do not wish it inferred that they are common. They are really safe drugs to use, when used properly. More can not be said of any drug.

As has been said, there are no end of drugs advised for grip. When there is no specific for a disease, one is impressed with this or that line of treatment in proportion to his knowledge of the man who advocates it and the terms in which he estimates it.

Burney Yeo, whose position as a clinician needs no comment, in his *Manual of Medical Treatment,* is so thoroughly convinced from his personal experience of the efficacy of quinine after two or three days preliminary treatment with such measures as I have described, his own preference being salicin, that I cannot refrain from mentioning it though I have had no personal experience.

He uses it in doses of gr. i to iii every three or four hours and prefers to give it in solution in citric acid; lemon juice would answer.

Certainly the doses are neither large nor frequent; the effect of quinine upon temperature and pain and to lessen metabolism and its freedom from bad effects are well known and would lead to no hesitation in its usage.

Tracheitis. Some involvement of the upper air passages or of the trachea is almost constant. In most cases it is slight and relief is afforded by local measures or by inhalations. Tracheitis is not uncommon, causing a nagging cough, and a feeling of rawness or discomfort under the sternum.

I am fond of a simple remedy that works admirably in many instances. A **mixture of equal parts of spirits of turpentine, spirits of camphor and olive oil** is made, a bit of flannel to cover the anterior chest is saturated with it and laid upon the chest, pinned into the night shirt and left on for the night. This may be made in the house. Order a tablespoonful of each, stir with the spoon and saturate the cloth. The patients inhale the fumes all night and marked relief to the feeling of soreness and tightness is afforded, the cough ameliorated and expectoration facilitated. **Camphorated oil** may be used in the same way.

Inhalations of **compound tincture of benzoin,** or of the **oil of pine,** a teaspoonful or two on a pitcher of hot water, or a teaspoonful to a pint in an inhaler, or a few drops of the **saturated alcoholic solution of menthol** on a pitcher of water will prove grateful.

If the **cough** is more harassing, **codeine** may be used in doses of gr. 1/8 to 1/4 (0.008–0.015 Gm) every two, three or four hours, or heroin in doses of gr. 1/10 to 1/12 (0.006–0.005 Gm) at the same intervals.

One of the most striking characteristics of this disease is the weakness and prostration of the patient after even a short course. In many, complications of a mental nature bespeak the profound effect of the poisons on the nerve centres.

Convalescence should not be hurried. Exposure after the attack has subsided, although a matter of two or three days is an invitation to relapse or complication. The danger must be explained to the patient and the demands of his body for further rest, as dictated by his weakness, be listened to rather than his mental protests and ambitions and business urgencies.

If the patient will assume this attitude towards himself, his returning strength will give the word for further indulgence.

In the meantime the **diet** should be made liberal to make good the ravages of the toxins.

Simple well-cooked foods, solid or fluid are indicated. **Light rubs** or **massage** given to the sore and tired muscles, **fresh air** and plenty of it, in bed or chair at first and later in the walks and, if the convalescence is unduly protracted, a change of air does wonders.

Patients should not get back to work until they feel again the impulse of health.

At this juncture **tonics** are supposed to be indicated. I believe one should feel that the best tonics are to be found in fresh air, sunlight, good food and properly proportioned rest and exercise rather than in drugs.

If our patients however, are not content, after such measures have been honestly adopted, we may try **strychnine** in doses of gr. 1/40 to 1/30 (0.0015–0.002 Gm) three or four times a day or tincture of nux vomica in equivalent dosage may be substituted.

COMPLICATIONS

Such is the treatment of a moderately severe attack of grip without complications; but it is the complications that makes grip the serious disease it is.

I have said that it is one of the most protean of diseases we have to deal with.

What organ may be implicated we do not know, but there are a certain number so frequently involved that we should never cease to keep our eyes open for the first indications of such an occurrence.

The respiratory tract in some part of its extent is almost certain to be implicated.

Otitis Media. We have just dwelt on the lesser manifestations of grip. Dependent on infection of the upper air tract is the common occurrence of otitis media.

I cannot dwell on all the phases of this important chapter of grip. What I want to emphasize is the vital importance of ever keeping it in mind.

In older patients the involvement of the ear is accompanied by pain, so that it is not likely to be overlooked, but in children and especially in younger children this does not hold true. It is the most common experience of a pediatrist to find the first evidence of an otitis in the discharge that has taken place through the ruptured drum.

In the acute infectious diseases of childhood it is good practice to examine the ears periodically and in such diseases as scarlet fever and influenza its neglect is scarcely pardonable.

Examination of the child's ear is not the easiest procedure in the world and so is commonly neglected by the general practitioner, but routine use brings its reward in facility acquired.

When treating a young child or infant for influenza, suspect the ear if there is a sudden exacerbation of temperature, often very high in children, or if there is a rise of temperature after the normal has been reached, or the child becomes much sicker without obvious cause for the manifestations.

The temperature of otitis in children may be long continued and sometimes with marked excursions.

Let me intercalate here that when I see long continued temperature in children with marked daily excursions, I always think of influenza, otitis media or Bacillus-coli infection and of course, in a malarial district, of malaria.

The incidence of otitis seems to vary from epidemic to epidemic and its virulency too.

That **mastoiditis** is all too frequent a sequel, that **sinus thrombosis** and meningitis may be, that some of the cases are fulminating should make us appreciate the seriousness of it, and seek special advice.

If this is not at hand a **paracentesis** or incision is simple and should not wait on temporary measures of relief.

Pneumonia. Another result of infection of the respiratory tract, much dreaded and constantly to be watched for is pneumonia. Influenza pneumonia has a high mortality, which differs in different epidemics.

While lobar pneumonia may occur with grip and run a regular course, the typical pneumonia is of the lobular type, bronchopneumonia.

As a rule this occurs a few days after the onset though it may be earlier.

Grip pneumonia is prone to be insidious. It occurs in scattered foci; it is often incomplete, its physical signs are very irregular, the subjective symptoms are out of all proportion to the objective.

It is frequently slow in resolution.

It is because of all these facts that the lungs should be examined daily. In two classes of patients the search should be especially assiduous; in old people and in children.

In old people the signs of bronchopneumonia are the least satisfactory. They may be absent entirely and the diagnosis be made on the degree of respiratory embarrassment and intoxication. The cough may or may not be prominent. The temperature may not be elevated.

The signs may be only those of localized bronchitis; that is, râles, or there may be only a little dullness and diminished breathing. One cannot watch the chests of old people confined to bed too closely. They are extremely susceptible to pneumonic processes, made much more so in a grip attack.

In children, too, it must be remembered that the physical signs are often slight and that the diagnosis may have to be made on the rapidity of respiration, prostration or cough.

The irregularity of distribution of the lesion, the incompleteness of the consolidation and the persistency of signs may give rise to the diagnosis of tuberculosis. Such a case in a young man, with consolidation at the left apex, a fairly high temperature with a good deal of excursion, a severe cough and a prolonged course I saw diagnosed as a case of acute miliary tuberculosis to the great distress and alarm of the family, in which tuberculosis had occurred.

Again, the retardation in resolution of these patchy and incomplete consolidations may occasion the same diagnosis.

When these cases are determined, they should be treated as pneumonia arising from other causes.[1]

Tonsilitis, bronchitis and **pleurisy** are to be treated in the same manner as if arising under other conditions.

Of **rhinitis** I would add a word.

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[1] See *Treatment of Pneumonia,* Chap. IV.

This is exceedingly common in influenza. It is often very distressing and accompanied by much frontal headache.

This usually means an involvement of the sinuses.

When the **frontal sinuses** are involved there is pain especially over the inner third of the orbital ridge and this pain is made worse by blowing the nose; when the ethmoidal sinuses are involved the pain is said to be deeper set or even occipital; when the antrum is involved there is pain in the superior maxillary, especially in the malar region and often a toothache on the affected side. Our efforts should be to endeavor to shrink the mucous membranes enough to open the ducts and passages to these sinuses to allow a drain. This may be done by spraying the mucous membrane with adrenalin 1 to 10,000 and after the drug has exerted its effect spray with an oily solution. I like one advised by Coakley—namely:

℞—Menthol	gr. xxx	(2. Gm)
Camphor	gr. xx	(1.30 Gm)
Eucalyptol	m. xx	(1.30 c.c.)
Olei rosæ	m. iii	(0.20 c.c.)
Benzoinol, q.s. ad.	oz. ii	(60. c.c.)

M. et S. Use in an oil atomizer.

If the **antrum** is involved, the head should be turned to the sound side, hanging a little over the edge of a pillow to facilitate the discharge.

The menthol solution as so given I find at times too strong. It may be reduced x or xv grains (0.60–1 Gm) or the whole may be diluted with more benzoinol.

If the nasal discharge is marked, order extract of belladonna, gr. $\frac{1}{8}$ (0.008 Gm), or atropine, gr. $\frac{1}{120}$ (0.0005 Gm), q. 2 h. until the discharge stops and then give at intervals of four to six hours to control it.

When giving belladonna so frequently, one should not forget that many people have an idiosyncrasy for it and should recall the early signs of accumulation, pupils widely dilated with blurred vision, erythematous eruption, scarlatiniform in character, excessive dryness of the mouth, and rarely a talkative delirium.

I have seen these coryzas outlast the attack until one despaired of ever giving relief and then clear up in forty-eight hours after **changing to a new locality.**

Of course one must be assured that there is not a suppurative process in one of the sinuses.

I might add that some of the cases run over into a chronic bronchitis or that small abscess cavities form or bronchiectatic cavities and that a patient may become a veritable bacillus carrier.

The nervous system shows the effect of the toxemia in no inconsiderable number of the cases.

Neuritis may occur as after any infectious disease and occasionally a true meningitis; but, as strikingly frequent, follow neuralgias. **Marked mental depression,** which all too often becomes melancholia, or other psychoses make their appearance. These must be dealt with as under other circumstances.

In children one may see symptoms of **meningitis** which are more commonly due to a **meningismus** or serous inflammation rather than to the presence of the influenza bacillus or other pyogenic organism.

In such a case a **lumbar puncture** should be done; first, that by examination of the fluid we may determine the presence or absence of the organism, whether it is purulent or not, that is, whether we have to deal with a purulent or serous meningitis; and second, because such a procedure often brings prompt amelioration of the symptoms. I have seen nothing more striking than the improvement following up this procedure.

I would emphasize two facts borne in upon me by my children's service at Bellevue Hospital; first, that this condition of meningismus, under which I include cases of serous meningitis, is extremely common in many acute infections and also in gastro-intestinal disturbances and second, that the differentiation from a suppurative meningitis is in a large percentage of these cases possible only by a lumbar puncture, a procedure followed by more fruitful results than any other measure of clinical diagnosis with which I am familiar.

Prolonged Fever. In some cases the fever drags out to unusual lengths. This is seen at times in children. They should be put in the fresh air as much as possible and their nourishment properly considered.

It is more than doubtful if any drugs have influence on this prolonged intoxication. When all other measures have failed there is one that has results so striking and on the whole so reliable that it needs an emphasis, namely **change of air.**

This is more easily attained with children, with whom transportation is a relatively easy problem.

Moreover, a removal to a remote quarter, to an entirely different climate, is not necessary.

Equally good results I have seen by sending cases to places no farther removed from New York than Atlantic City, Lakewood or Greenwich, nor have I been able to determine that the woods or the shore offered any peculiar advantage the one over the other. I have seen a child sent to Lakewood after running a temperature for weeks with prompt subsidence of symptoms, only to relapse on a return home, to as promptly subside again after a second trip to Lakewood. There a longer residence effected the cure. These prolonged cases in children associated as they often are with a cough and a slight bronchitis not infrequently arouse the fear of incipient tuberculosis.

PROPHYLAXIS

Were the mortality of influenza as high as that of tuberculosis or of pneumonia or were the mortality directly traceable to the infection as in the case of typhoid, no doubt we should more fully appreciate the importance of prophylaxis and urge its carrying out, but we do not look upon influenza as a highly dangerous disease and we do not attribute the deaths from pneumonia to the Influenza infection with sufficient emphasis, so little precaution is taken to protect the individual or the community.

There are three ways in which the disease is especially spread, first by those who are a little ill, are suffering from a "common cold" and move about among their fellows, infecting as they go; second, by the very ill who infect other members of the family or attendants because knowledge of the mode of transmission is not known and precautions are not insisted upon by the attending physician; and third, by the carriers of the bacilli, people with a chronic cough, sufferers from chronic bronchitis, bronchiectasis or abscess.

Lord found the organism of **Pfeiffer** present in 25 to 59 per cent. of unselected cases of chronic cough and expectoration in interepidemic periods.

With the first class of cases, patients should be instructed as to the meaning of "common colds" that occur in epidemics, how easily their cough, with its spray of infecting organisms, can pass on the disease of perhaps fatal severity to those in contact with them; that coughing and sneezing should be done into a handkerchief, that sputum should be destroyed and that intimate contact, kissing, etc., should be seduously avoided.

Perhaps no more certain source of infection exists than the common carriers.

How, wedged into a car or train, in the hours of crowded traffic, with sneezing and coughing all about, with insufficient ventilation or such a one as constitutes a draught to blow over the heated skin, could one escape infection? So far as possible these places should be avoided during an epidemic.

Of the second class of cases, the family should be instructed that the patient is a source of infection and that remaining unnecessarily long with the patient increases the danger; the nurse should be instructed to see that the secretions are received into proper receptacles, vessels provided with 5 per cent. carbolic acid, or into cloths that should be burned; that the clothes in contact with the patient should be sterilized by boiling, that his utensils and thermometer be kept separate and that after he has convalesced, the room should be fumigated with formalin.

With reference to the third class of cases, more difficulty exists until the health authorities make more inquiry into the nature of chronic processes and take measures for the public protection.

SUMMARY

Rest.

Bed. Half bed of iron of hospital type preferred in severely ill.

Room.

Light and air.
When the attack is trivial the patient should be advised to remain in the house and assured of a shorter course if he goes to bed.

Onset.

Chill.
Hot drinks, water, tea, lemonade, whisky or brandy.
Hot water bags to feet, blankets.

Fever.

Sponge bath with tepid water.
Alcohol rub.
Cold cloths to head.
Cracked ice to suck.

Bowels.

Saline cathartic.
Seidlitz powders, liquor magnesii citratis ℥viii–xii (240–360 c.c.) Rochelle or Epsom or Glauber's Salts ℥ss–i (15–30 Gm) or begin with Calomel (Hydrargyrum chloridi mitis), gr. ¼ (0.015 Gm) every quarter hour for six doses.
Follow in three to four hours by saline.

Diet.

No food at onset. Later milk, eggs, cereals, gruels, toast, broths, mutton or chicken, thickened with rice, barley or other flour or cereal.
In prolonged complicated cases consider caloric needs.
See Chap. II and V.

Symptomatic treatment.

Sthenic period of Toxemia.
Drugs.
Antipyretics.
Acetanilid, antipyrin, phenacetin (acetphenetidin).
Acetanilid.
In small doses frequently repeated, either alone gr. iss–ii (0.10–0.15 Gm) or in combination. For example.

℞

Acetanilidi	1.50	gr. xxiiss
Sodii bicarbonatis	1.00	gr. xv

Caffeinæ citratæ .... 0.50 gr. viiss
M. et Divide in capsulas no. xv.
S. One every hour for four doses, then every two hours.

As improvement occurs make the dose every three hours and every four hours.

- Phenacetin.
  - May be given alone in doses of gr. ii–iiss (0.125–0.16 Gm) or in combination with sodium bicarbonate and caffeine as above.
  - Give at same intervals as the acetanilid.
- Antipyrin.
  - May use like acetanilid and phenacetin.
  - Dose when frequently repeated gr. ii–iiss (0.125–0.16 Gm).
- Salicylates.
  - Especially aspirin in capsules, gr. v (0.30 Gm) every two hours.
  - Quinine in capsules, gr. i–iii (0.060–0.20 gm) or in solution in citric acid, gr. x (0.60 Gm) in lemon juice, every three or four hours after two or three days of preliminary treatment with salicin, e.g., gr. v–viiss (0.30–0.50 Gm) (Yeo).
  - Or this may follow two or three days of acetanilid, phenacetin or antipyrin treatment, outlined above.

Tracheitis.

- Apply to anterior chest, over sternal region flannel saturated with
  - Oil of turpentine,
  - Spirits of camphor,
  - Olive oil, equal parts. Leave on all night, or
  - Camphorated oil applied in the same way.
- Inhalations.
  - Steam from croup kettle, pitcher of hot water with paper cone, or from some simple inhaler. Pour on to this hot water ʒi-ii of compound tincture of benzoin, or oil of pine or oil of eucalyptus.
  - Inhale as often or as long as it is grateful. Pour onto the hot water a few drops of a saturated alcoholic solution of menthol and inhale.

Cough.

- Codeine phosphate in solution gr. ⅛–gr. ¼ (0.008–0.015 Gm) to ʒi (4 c.c.) of water every four, three or two hours according to severity; or codeine sulphate in tablets in same dose.
- or
  - heroin, gr. $\frac{1}{12}$–$\frac{1}{10}$ (0.005–0.006 Gm) at same intervals.

Convalescence.

- Care to avoid exposure to inclement weather conditions or to undue exertion or fatigue immediately after an attack, even when mild, lest a recrudescence or complication like severe bronchitis or pneumonia ensue.

Diet.

- Should be made more liberal.
  - Fresh air.

Massage.
Tonics.
Strychnine, gr. 1/40–gr. 1/30 (0.0015–0.002 Gm) or Tr. Nucis Vomicæ m. x–xv (0.60–1 c.c.) three or four times a day.

Complications.

Otitis media.
In children, ears should be examined every day, regardless of symptoms referable to ear.
(The magnifying electric otoscope greatly facilitates these examinations for the general practitioner.)
When the drum is inflamed and bulging, incise the drum (paracentesis or myringotomy).
If in doubt about the indication for the procedure, incise.

Pneumonia.
Examine the lungs daily and with especial care in the aged and feeble.
Treat as under other circumstances.
(See Pneumonia, Chap. IV.)

Tonsilitis, Bronchitis and Pleurisy.
Treat as under other circumstances.

Rhinitis.
Treat as under other circumstances.

Sinusitis.
Spray the nose with a cleansing solution, 2 per cent. boric acid solution.
Quarter to half strength Dobell's Solution, or one of the numerous equivalents on the market. This to clear the mucous surfaces of secretions.
Follow with adrenalin spray 1–10,000 or stronger (1–5,000, 1–2,000) or use any other epinephrin solution.
(This to shrink the mucous membrane and open the sinuses.) Follow this with sprays to prolong the effect of the adrenalin.

e.g.,

Menthol	gr.	xxx	2.00
Camphor	gr.	xx	1.30
Eucalyptol.	m.	xx	1.30
(or one can use 1 per cent. of each)			
Olei rosæ (may be omitted)	m.	iii	0.20
Benzoinol	q.s. ad.	℥ii	60.00

M. et. S. Use oil atomizer.

If antrum is involved, turn to sound side and hang head off edge of pillow to facilitate discharge.
Extract of belladonna gr. ⅛ (0.008 Gm)
or
Atropine sulphate gr. 1/120 (0.0005 Gm)
every six to four hours.

Persistent rhinitis.
Change of locality.

Mental depression.

Requires watchfulness, as true melancholia with its self-destructive impulses may follow.

Meningeal manifestations.

(See text.)

Prolonged Fever.

When not due to complications will often yield to change of locality.

Prophylaxis.

- Instruction in the meaning of "common colds," their infectivity and the condition they may give rise to in another.
- Avoidance of too close contact with those suffering from "colds."
- Danger of coughing, sneezing and kissing during attacks of "colds."
- Dangers in crowded cars and crowds during epidemics.
- Destruction of secretions from those suffering from Grip.
- Avoidance of close contact with Grip patients.
- Knowledge that individuals suffering from chronic cough are in a large per cent. of cases "carriers" of the influenza bacillus.

CHAPTER IX

SCARLET FEVER

THE **causative agent** in scarlet fever remains **unknown** up to the present time, but the close association of the streptococcus pyogenes with this disease and its certain etiological relationship to many of the most serious manifestations, concomitant or sequential, of the disease, makes it of great importance from the standpoint of therapy.

The **period of incubation** is an important one, because it measures the time during which a child exposed to scarlet fever may become a source of infection to other children and the time during which contact with other children should be avoided.

Unfortunately, there is no precise agreement as to this period or, perhaps, the period itself varies considerably, resulting in statements by various observers that range from one day to three weeks. Excellent authority may be quoted for two to four days and ten to fourteen days. My inclination is to anticipate the shorter period; but, considering it from the standpoint of possible danger to others, to set the limit of isolation of the exposed at three weeks.

The **onset** is usually abrupt, beginning with **vomiting** in the vast majority of the cases, **a sore throat,** a considerable rise of **temperature,** and in twelve to twenty-four hours an **erythematous eruption.**

Unfortunately for the clinician, the diagnosis is often made difficult by deviations from the type. The eruption may be delayed for three, four or five days or be atypical or evanescent. The sudden onset with vomiting, sore throat and a rise of temperature, should always make one suspect scarlet fever. The **bright injection of the throat** and an increasing **leucocytosis** and **polynucleosis** enhance the probability. McCollom lays great stress on the **hypertrophied papillæ** at the tip and edge of the **tongue,** like small grains of cayenne pepper scattered upon it. If the eruption has been evanescent, overlooked or doubtful, the papillæ growing daily more distinct, the increasing **eosinophilia** as the temperature disappears and the leucocytosis decreases, the evidences of **desquamation** or the late onset of **nephritis** finally fixes the diagnosis and determines certain precautions for the patient and those who might be infected by him.

Distribution of the Family. The diagnosis once made or with good reason suspected, immediate measures must be taken to protect other members of the family, who have not had scarlet fever.

The ages of the individual members of a family determine different precautions.

With reference to the **adults,** two facts are to be kept in mind; first, that recurrence is so rare that those who have had it have little to fear for themselves, but may convey the disease to others; hence, adult members of the family should come in contact with the patient as little as possible and those who may come in contact with children outside should keep remote from the patient, or, if the contact with other children is intimate, should remove from the house during the course of the disease. Second, that susceptibility decreases with years; McCollom's figures show that of 5,000 cases less than 5 per cent. occurred after twenty-four. The adult, then, who has not had the disease, runs a risk which should be avoided if possible, but a risk that is so slight that it yields to pressing exigencies.

The **other children in the family** should be removed to another house and there kept from contact with other children until the longest period of incubation, which we may take as long as three weeks, has passed. Their return home will depend on the patient's length of illness and upon the complications, which, themselves, may lengthen the period of infectivity; e.g., discharging ears.

They should not be allowed to go to school until this incubation period has passed or, if there is communication between them and the patient through other members of the household, they should not return to school until the patient is recovered and the danger of their own infection is passed.

When it is not possible to remove the other children, every contact with the patient, direct or indirect, must be avoided to the best of the ability of those concerned. It has been claimed that isolation can be effected more certainly in scarlet fever than in measles, but it must be remembered that the susceptibility to the former infection is not so great as is the case in the latter; hence, dependence on such isolation can not be offered as a reason for keeping other children at home, if it be possible to remove them.

It must be remembered, too, that a light case in one patient in no way assures that the infection will prove light in the others; an assumption to which parents are peculiarly prone.

THERAPY

Room. To begin right is to win half the battle and an unwillingness to inconvenience the rest of the family must not stand in the way of the patient's needs. That room in the house which will meet the demands of the physician, nurse and patient best must be given up to him. The demands of the patient are **space, ventilation, light, cleanliness**; those of the nurse are economy of effort in managing the room; **access to a bath room** devoted to the patient; nearness of her own room; those of the physician, ease of ingress and egress with minimum danger to the family.

This ideal can be attained in commodious quarters, but only approximated elsewhere.

The room must be large enough with enough windows to avoid being stuffy and afford good ventilation, without exposure to draughts. A top floor room is excellent or one with approach to a balcony or one at the side of the house affording a special entrance. Moreover, **sunlight** as well as air must have access to the room. Both cleanliness and economy of effort are afforded by **stripping the room** of furniture, carpet, hangings, pictures, etc. The **floor** may be bare or covered with carpet lining and over this unbleached muslin. An open fire-place has its advantages for the sick room.

Isolation is made more complete by sealing doors leading to other rooms or hallways, except that in use. This sealing may be done with strips of paper laid along the cracks and reenforced to several thicknesses. Gum tragacanth makes an excellent paste, is easily removed and does not stain or injure paint.

The **admission** to all rooms used by the patient, i.e., the sick room, the bath-room, the nurse's room, should be **protected by sheets.** If the first entrance is to the bath-room and then to the sick room, both entrances may well be protected. An arrangement that has advantages is two sheets to the door entering the sick room; one on the inside and one on the outside of the entrance or portal. The one attached to the top and right side, the other to the top and left side.

The **floor** and **woodwork** should be rubbed down with damp cloths or cloths saturated with 1 to 1,000 bichloride of mercury from time to time and the cloths burned. If the floor is covered, then the same strength bichloride may be sprinkled on the covering from time to time. It is customary to saturate the inner sheet with 1 to 20 carbolic or with bichloride solution, but the heavy odor of the carbolic and the amount of toxic material that must be introduced into the room to keep the sheets wet through all the weeks of illness makes it objectional.

It would seem better to replace the sheets from time to time, destroying the old, if made of cheap material or sterilizing them if of good material.

The Nurse. In a disease necessitating so close confinement and demanding so close attention, there should be both a day and a night nurse. If this be not feasible, a member of the family should lend assistance, but then should be as completely isolated from the rest of the family as the nurse. When nursing devolves on the mother or other member of the family their isolation from the rest of the family is a duty that must be emphasized by the physician and, all the more, because it is so difficult to make the necessity understood and observed.

In the presence of the patient the nurse should **wear a gown and a cap** that covers the hair completely and in the care of a bad throat and in the handling of secretions, rubber **gloves.**

An occasional antiseptic **spray** to the throat is a wise precaution. The nurse should not come in contact with other members of the family or with people outside the sick room unless the occasion be imperative and then she should subject herself to the same kind of disinfection as on leaving the case. The nurse should not sleep or eat in the sick-room, but should have a room adjacent to the sick-room devoted to herself.

Taking air or exercise, the nurse should choose that time of day and those localities that minimize the possibility of contact with susceptible individuals. Clothes should be changed and hair washed.

The Physician. In an outer room the physician should leave his overcoat or, better yet, his coat and vest, and entering the bath-room or some small ante-room where his accouterments for the sick room are left, don a **gown,** long to the floor, and tight at wrists and neck. In addition he should have a **cap** to cover the hair, and a pair of **rubber gloves** if he is to examine the throat, as he ought to do. Wearing **rubber shoes** and turning up the trousers are precautions worth observing. All instruments used in routine examination, including the stethoscope, should be left in the sick room or bath-room and disinfected before using again.

While an honest and conscientious examination of the patient should be made, undue loitering and prolonged examinations only add to the peril of some other patient.

On leaving the patient, the physician leaves the gown, cap, shoes and gloves in the bath-room or ante-room, and washes his face and hands thoroughly with soap and water. This is more important than the antiseptic to follow, upon the efficacy of which the physician's faith is often of too childlike simplicity.

Following the soap and water, alcohol furnishes an excellent antiseptic, or bichloride in the strength of 1 to 1,000 or carbolic or lysol in the strength of 1 per cent.; but to both the carbolic and lysol the objection of the clinging and disagreeable odor attaches, while they are less efficacious than those mentioned.

When a gown may not be obtained, a sheet may be arranged about the person in such a way as to effect the same purpose as a gown. In the absence of any such protection or in a visit to a suspected case, the overcoat and street gloves may be worn.

Full duty to the public who trust the physician is done only when he changes his clothes and better yet takes a full bath before seeing other children. Unfortunately, this is a rule rarely followed; hence, only the most rigid precautions on occasions of visits to the scarlet-fever patient can minimize the danger entailed by such a failure of proper observances. He should plan to see the case only early or late or allow some interval between this visit and the next on a child, spent in the open air. He should not take obstetrical cases or do surgery.

Precautions in the Sick Room. Articles in common use about the patient, when of such a nature as to permit it, should be kept in an antiseptic solution. The **thermometer** must be left with the patient. No effort at disinfection will justify its use among other patients. It may be kept in carbolic, 2 per cent. or stronger up to saturation, 1 in 20. The **tongue depressor** should be of wood or glass. If of wood, to be destroyed by burning after each usage; if of glass, kept in carbolic like the thermometer. **Syringe nozzles** whether of hard rubber or glass (and they should not be of glass when used to irrigate the throats of young children, lest they be bitten and broken), are to be treated in the same manner.

Dishes, knives, forks, spoons used by the patient or nurse should be boiled for at least a half hour. A small gas stove in the bath-room or adjoining room facilitates the procedure. If the utensils are removed from the sick room to be boiled, they should first be soaked in 1–20 carbolic for 20 minute to ½ hour.

Urinals, bed-pans and sputum cups should be disinfected with carbolic one in twenty and the same strength carbolic should stand in them when not in use.

Bed-linen should be soaked over night in carbolic, 1–50 to 1–20, and then boiled for a half hour before being sent to the wash.

Discharges from the mouth, nose and ears are better caught on pieces of gauze or cloth that can be burned at once.

Cats, dogs and birds should be excluded. Only a few books or toys and such only as may be destroyed later are permissible.

Temperature of the Room. Thorough ventilation with avoidance of draughts upon the patient is the desideratum; 65° F. to 70° F. are the figures usually given and are useful to prevent overheating in the colder months, but in the winter, cold itself is not dangerous but helpful, providing the patient's body is properly protected and the temperature brought up to 70° F. before the body is exposed for any purpose.

Bed. See Pneumonia, Chap. IV. The weight of clothing is determined by the comfort of the patient and the temperature of the room.

Patient. The patient must be put to bed; an injunction, which while unnecessary in severe cases, meets with opposition in the mild ones. An explanation of the consequences, in terms of kidney complications, especially, will persuade the parents.

A tepid sponge bath is given each day, which, given on a blanket, exposing one part after another, in a warm room, entails no danger.

Nightgown. This should be of flannel and if this is too irritating to the skin, a thin cotton or silk undervest may be worn under it.

Diet. The diet in scarlet fever is determined by the same fundamental principles as obtains in the arrangement of a dietary in other acute infections, except so far as the frequency of nephritis may modify it: (See Diet in Acute Infectious Disease, Chap. II) i.e., in the first few days of the infection, when anorexia is marked or the angina entails much suffering from the act of deglutition, the feeding should not be pushed beyond the patient's inclination; but after that period has passed, the theoretical needs of the body must be taken into consideration.

The frequency and severity of the nephritis which comes late in the course of scarlet fever determines greater precautions in scarlet fever than in any other of the acute infections.

Many authors write as if any article of food other than milk might precipitate an attack of nephritis. I think we are convinced to-day that the nephritis is due to the toxins of the disease or to other infectious organisms or their toxins accompanying the disease, such as the streptococcus, whose action would not be modified favorably by an insufficiency in quantity or quality of food. That a constant examination of the urine for the first, least evidence of nephritis should be made, ought to be emphasized and when such evidence appears, then the kidney should be given the greatest degree of rest compatible with the imperative needs of the rest of the organism, like any other damaged organ.

The consensus of opinion is that milk has proved itself, empirically, to be the best single article of food in scarlet fever; but that it should be the only article of food in scarlet fever or that it has proven to be specific as a preventative of nephritis is doubtful.

The three great functions of the kidney are the elimination of water, of salts and of nitrogen. It is desirable to heap no excess of the one or the other upon the kidney. They are nicely proportioned in milk; for example, 2 quarts of milk furnishes about the average water intake for twenty-four hours. In these 2 quarts of milk are about 70 grams of proteid, or 11 grams of nitrogen. While this amount of proteid is below the average proteid intake of a man in health, it is enough to maintain him in health, as Chittenden's experiments showed and in disease a "luxus consumption" should be avoided as putting a burden on the kidney. In these 2 quarts of milk are about 3 grams of salt.

This amount is way below the average salt intake, but in health we use salt largely as a condiment and so small amounts as here given more than meet the actual physiological needs. Moreover, sodium chloride is illy excreted when the tubules of the kidney become impaired.

Two quarts of milk, however, furnish but 1,280 calories of food; less than 50 per cent. of the demands of a man of average weight in fever. If sufficient milk were given to meet the caloric needs of 3,000 calories, twice as much proteid and twice as much water as is required would be administered. To meet the caloric needs, either the milk must be fortified or other articles added. The milk may be fortified by adding to each glass milk-sugar or cream or both. One ounce of cream, 16 per cent., 50 calories, 7 ounces of milk, 140 calories and ½ ounce of milk sugar, 60 calories, makes 250 calories to each glass of 8 ounces or 2,000 calories to the 2 quarts.

Additional sugar may be introduced in such drinks as lemonade or orangeade.

Other milk preparations, cereal gruels, well-cooked cereals (oatmeal has been objected to on account of a high purin content), bread and butter, milk toast are suitable for the dietary. Among the cereals and flours are to be mentioned arrowroot, rice, barley, cornstarch, flour, farina, imperial granum; all of which can be made into gruels; or they may be used without the milk in the shape of jellies of barley flour, tapioca, sago or thoroughly cooked farina, rice, cornmeal.

Vanilla ice-cream or lemon ice may be allowed from time to time.

The basis of the dietary, then, is milk; modifications of milk, such as koumys, buttermilk, matzoon, zoolak, cereal gruels, cereals, bread and butter and milk toast being added when the milk disagrees or when the appetite lags from the monotony of the diet.

After the period when a nephritis is likely to ensue, more articles may be added to the diet; eggs, custard, potatoes, other vegetables, oysters, fish and finally meat.

Meat soups should be avoided at all stages, because they contain largely, almost exclusively, nitrogenous extractives which have little or no nutritional value, but must be excreted by the kidneys.

CALORIC VALUES

Milk	20	Calories per ounce
Cream, gravity	50	Calories per ounce
Koumys	14	Calories per ounce
Buttermilk	80	Calories per glass
Whey	56	Calories per glass
Sugar	120	Calories per ounce
Bread	100	Calories per slice (about 12 slices to a 1-pound loaf)
Barley (meal or flour)	1640	Calories to the pound
Wheat flour	1625	Calories to the pound
Farina	1685	Calories to the pound
Baked custard	183	Calories to 2 heaping tablespoonfuls
Tapioca	1650	Calories per pound
Rice	1630	Calories to the pound
Cornmeal	1655	Calories to the pound

Butter	119 Calories per ball (½ ounce)
Oysters	88 Calories per dozen
Fish	100–150 Calories per ¼ pound
Eggs	70–80 Calories per egg
Potatoes (white)	About 100 Calories for medium size (4 to 5 ounces)

The caloric requirements in short acute infections may be disregarded.

The caloric requirements in prolonged infections are some 25 per cent. more than in health and often much more is taken with benefit.

We try to meet the theoretical requirements, while not disregarding the patient's appetite and wishes too violently, but if the patient will take more than these requirements willingly and handles it well we should give it to him.

Water. Water or lemonade or orangeade or the juice of grape fruit or grapes may be given freely. Imperial drink, a tablespoonful of cream of tartar (acid potassium tartrate) to 3 pints of boiling water (to get it in solution) to which sugar and lemon peel is added to suit the flavor, is a grateful drink and a good diuretic.

The amount of fluid to be taken should be well above the 2 quarts taken in health. Drink should be offered every hour and the patient allowed to take such quantities as he will. It must not be left to the patient to ask, as he is often too sick to do so.

Skin. The patient should have a **sponge bath** once or twice a day both for comfort and cleanliness. It should be done in a warm room, between blankets and as a precaution against chilling, which in a fever seems to me over-exaggerated, one part of the body at a time is exposed for the bath.

Itching and burning of the skin is often an annoying feature of the exanthem. This may be allayed by sponging with a solution of **soda bicarbonate**, a teaspoonful in 3 pints of water, or a **bran bath**, a handful of bran in a muslin or cheesecloth bag immersed in a gallon of water until it becomes slightly milky in appearance, or the skin can be kept well dusted with a **rice** or **talcum powder.**

Calamine lotion, ʒi (4 Gm) calamine to 1 pint (500 c.c.) of aqua calcis. For **extreme itching** 1 per cent. to 2 per cent. **phenol** in olive oil.

When **exfoliation** begins **cocoa-butter** or **vaseline** may be applied; if 1 per cent. to 2 per cent. **phenol** be added to the latter it allays the itching and burning.

Soaking in warm water helps to get off the peeling skin; picking, rubbing and scraping the skin to expedite the desquamation is not justifiable, for it wounds the skin and opens antra of infection.

The care of the **mouth, throat and nose** is of supreme importance, because the throat is often the seat of streptococcus or other pyogenic invasion, which, neglected, may permit of the spread of the infection by direct extension, into the ears, air passages, nose and accessory sinuses, while by way of the blood stream and lymphatics, the glands, joints, kidneys and heart may be attacked.

All procedures must be thoroughly and conscientiously carried out, but with extreme gentleness, because of the pain produced by carelessness, but much more because the wounded surface invites the entrance of infection. For the same reason, mild applications are indicated.

Physiological salt solution ʒi to Oi (4 Gm to 500 c.c.), boric acid solution, 2 per cent. to 4 per cent., or half strength Dobell's Solution (a weak solution of bicarbonate of soda and borax, āā ʒii to Oi (8 Gm–500 c.c.) with about ⅓ of 1 per cent. carbolic acid) seem to me to be the safest substances to use whether in the shape of simple mouth wash, spray or irrigation.

After taking food the mouth should be rinsed with one of these solutions, the **teeth** cleansed with a cotton swab on a wooden tooth pick wet in the solution and the dead spaces between lips and teeth and teeth and cheeks searched for particles of food or collections of secretions by the same means.

The sicker the patient the more painstaking should be this search.

For **sordes** on lips or teeth and for the thick coat upon the tongue, half strength of hydrogen peroxide (official) should be applied before the milder solutions. Much of the coat may be removed from the tongue by gently scraping the tongue after this treatment with the edge of a whalebone, but there must be no violence.

When the **mouth** is very **dry** equal parts of 2 per cent. boric acid solution and albolene with a little lemon juice added is efficacious and pleasing. If the breath is fetid, the mouth foul and stomatitis in evidence one may make an application of the following solution:

℞—Phenol (watery solution 1 in 20)
Glycerin .... āā ʒi (4 c.c.)
Boric acid (saturated watery sol.) ..... ℥viii (240 c.c.)
M.

This is followed by the milder solution.

The same solutions may be used for the **nose**; dried secretions being previously moistened and softened by application of sweet oil or vaseline. Application should be made with cotton on a tooth pick and very gently. Sprays may also be used.

Irrigations are to be avoided unless special indications arise, as the solution may make its way with infectious material into the Eustachian tube and set up middle ear disease.

For the **throat** gargles are of little use. The spray is much better and irrigations of hot saline solution ʒi to Oi (4 Gm–500 c.c.)

are safer here and very grateful. The milder solutions are to be used unless the angina is severe.

The **genitals** should be carefully inspected and kept clean by the use of the same solutions.

Bowels. When first seen a free catharsis should be induced, one or two watery stools. One may begin with **calomel** in gr. ¼ (0.015 Gm) doses every ¼ hour for four or five doses and follow with salts.

Calomel is easily taken and well borne by children in these doses and if there is nausea the calomel acts as an antiemetic. In the child this dose may be followed by milk of magnesia ℥ss (15 c.c.) or Liq. magnesii citratis ℥vi to viii (180 c.c.–240 c.c.) or Rochelle salts ʒii (8 Gm). In the adult the doses of salts are doubled or Epsom salts or Glauber's salts may be given in doses of ℥ss (15 Gm).

If nausea continues, cracked ice, or bicarbonate of soda in doses of gr. x–xv (0.60–1 Gm), may be used, or small doses of bismuth gr. xv (1 Gm) or of cerium oxalate gr. v (0.30 Gm) are of value. An excellent prescription calls for a combination,

℞—Bismuth subnitratis	gr. xv	(1. Gm)
Sodii bicarbonatis	gr. x	(0.60 Gm)
Cerii oxalatis	gr. v	(0.30 Gm)

M.

This may be given stirred in a little water and repeated at two hour intervals if needed.

The bowels should be kept open by the use of enemata every other day or by mild cathartics, such as Liq. magnesii citratis, Hunjaydi or cascara.

TREATMENT OF SYMPTOMS

Fever. It is well to bear in mind that the symptoms of disease are often of conservative significance, of purposeful intent, subserving some definite function in combating the agents of disease or the results of their invasion, and that interference is indicated only when this purpose has failed and when pyrexia, too, is adding a burden, not to be endured.

Fever, so far as we can read its signs, points rather to the establishment of a condition in an acute infection which enhances the efforts and efficacy of the various modes of reaction against the causative agent and its products. If we accept this view there is no reason to attack temperature under all circumstances and, as often, with measures themselves harmful. But we have to learn that this useful temperature may, under conditions, become in itself a danger. These conditions are excessive temperature or long sustained temperature and that the term, hyperpyrexia is a relative one; for a febrile reaction of 105° F. would scarcely be considered as hyperpyrexia if of short duration; it becomes a decided hyperpyrexia if sustained for days. Another fact to be borne in mind is that the fever is loaded with the onus of the toxic effects of the *materies morbi* upon the nervous system and upon the cardio-vascular and respiratory apparatus. The measures that empiricism has directed against fever are successful because they combat the effects of toxæmia upon the organs mentioned.

A moderate degree of fever, then, 104° F. or below is to be let alone, unless accompanied by other evidences of toxæmia, but when above this and sustained, efforts are to be made to reduce it. (For more detailed discussion of fever see Chap. I.)

The one measure that outranks any other as an antipyretic both in its efficacy and safety is the application of cold through water as the conveying agent.

For infants sponging is best; for children the pack and sponging; for early and middle adult life the pack or bath.

Neither the eruption nor the fear of kidney complications should contraindicate the measure.

We are discussing here hyperpyrexia as such and the object of any procedure is extraction of heat. It is well with children to begin with water relatively warm, 95° F. to 90° F. and increase the degree of cold, to 80° F., 75° F. and 70° F. or colder, the degree of cold and the length of the bath depending on the result in terms of reduced temperature and the reaction of the patient.

The patient is to be carefully watched. When the temperature falls to 102° F. or thereabouts, the bath should be interrupted.

If the patient becomes thoroughly chilled or shows any evidences of collapse, the procedure should stop, the patient be wrapped in a dry blanket, heat placed at the extremities and hot drinks given.

When high temperature is accompanied by collapse and clammy extremities, heat should be applied to the extremities and cold in the shape of compresses or sponges to the trunk.

Angina. Strictly speaking angina is a complication of scarlet fever, but a complication so frequent that it may well be considered as characteristic.

We are considering here not the erythematous angina, which has just been touched upon in considering the care of the mouth, but the membranous or gangrenous angina. A membranous angina may occur in every degree of severity, from a small patch here and there to a spreading membrane, covering tonsils, palate, pharyngeal wall and invading the nose and Eustachian tubes. The gangrenous type may be secondary to the membranous or occur as primarily such.

The invasion of the nose and the sinuses, the middle ear, the accompanying adenitis, the possible pneumonia, the ensuing nephritis, the severity of the toxæmia and the fact that not only the streptococcus but the Klebs-Löffler bacillus may be concerned in the formation of the membrane make the condition not infrequently a most serious menace to life, demanding the most conscientious and scrupulous consideration.

In the first place let it be emphasized that the presence of membrane should mean diphtheria until excluded and while in the majority of cases the diphtheria bacillus is not present the percentage in which it is, especially in hospital practice which represents patients drawn from the poorer and congested districts, is alarmingly large.

One should never trust to clinical descriptions for differentiation, but **take a culture** in each instance. If such facilities are not at hand, the patient should be given the benefit of the doubt and a sufficient dose of antitoxin, 10,000 units. If the case is a very severe one and unchecked by cultural data, the antitoxin should be used as in a case of diphtheria.

When the culture is taken, wait upon the report and, if positive, treat as a diphtheria. If there is any laryngeal involvement, it is almost sure to be diphtheritic and the antitoxin should be used at once, not awaiting the return on the culture. Give 10,000 units and repeat in eight hours if no improvement or in four or six if getting worse.

Whether the membrane is due to streptococcus alone or to both it and the diphtheria bacillus, the procedure is the same, in other respects than in the administration of the serum.

Two facts are to be kept in mind. 1. That cleanliness of the parts is the desideratum and that the mildest solutions and the mildest manipulations must be used. 2. That the local condition can be aggravated and its spread and invasion of other structures be facilitated by injury to the parts, either through the irritating or corrosive effects of the applications or the mechanical injury done in the application; and that it is extremely doubtful if any of the so-called antiseptics have any effect to kill appreciable amounts of the infecting organisms.

The modes of application are **irrigations, gargles, sprays, inhalation** of vapor and topical application with a swab.

The most reliable of all these modes of application is the **irrigation** and the most useful substance hot **physiological salt solution,** one teaspoonful of common salt, sodium chloride, to the pint of water.

The patient's head is supported by pillow or rest unless too sick, then the head may be turned to one side, a towel tied about the neck, a pus-basin or other receptacle held beneath the chin and the stream of saline directed from a fountain syringe or irrigator held a few inches above the head, but not high enough to exert force, through a hard rubber nozzle, or through a rubber tube, such as a catheter, against the affected parts, the tongue being gently depressed with a wooden or glass tongue depressor. If very young children are so treated, the nozzle may be placed between the molar teeth and the stream directed to the tonsils and pharynx. The excess runs out into the basin.

The amount used should be 1 pint to 2 quarts, according to the demands and the effects on the patient. The temperature should be as hot as can be comfortably borne. One must determine this empirically, beginning with a temperature of 110° F. to 115° F. in the adult and 100° F. in the young child.

The frequency every two to three hours in the day and every four hours at night.

Not only does this clear the throat of secretions and wash away loose membrane, but it relieves the pain in no small measure and induces a moderate degree of hyperæmia, which may itself be a factor in resolution.

Half saturated **boric acid** solution, 2 per cent., or **Dobell's solution** diluted from two to four times may be used as the irrigating fluid.

If there is much tenacious mucus in the throat, an abundant spray or preliminary irrigation with a solution of sodium bicarbonate gr. xx (1.30 Gm) to the ounce or one containing

Sodii bicarbonatis		
Sodii biboratis	aa gr. xxxij	2 Gm
Aquæ dest. q.s. ad.	℥ iv	120 c.c.
M.		

(L. Browne in *Coakley on Diseases of the Nose and Throat.*)

may be used to rid the throat of this material before the saline irrigation is given.

If there is a considerable deposit of **membrane** or in any case, applications, preferably by spray or very gently with the swab, of full strength of **peroxide of hydrogen** may be used. It may be better borne in full strength on the swab than in the spray and the latter diluted one to two or three times.

In a bad throat, then, one may get rid of the tenacious mucus by the alkaline spray, then touch the exudate with the peroxide of hydrogen and finally use the hot saline irrigation. If the process is fatiguing, or causes discomfort, it must be simplified as much as is consistent with results.

Sprays of saline, boric acid solution or Dobell's as above may be given between the irrigations as often as they prove grateful to the patient.

Inhalations of hot vapors are sometimes appreciated by the patient. It may be merely steam or steam medicated with compound **tincture of benzoin,** ʒi to the pint of hot water or **oil of eucalyptus.**

These may be used in a croup kettle or one of the simple devices on the market or a common kettle with a cone at the nozzle to direct the steam or a pitcher of hot water with a cone over it.

Gargles are in no sense a substitute for irrigation or spray, first, because they do not reach the affected part thoroughly and, second, because the act of gargling is in itself often very painful. If the patient, however, finds relief by such a measure there is no contraindication. One uses the same substances as in the spray or irrigation.

Cracked ice, held in the mouth and sucked, often gives great comfort.

Cold applied to the neck in the shape of **compresses** or **coils** or **ice-bags** may afford great relief. They must be properly applied and not allowed to annoy.

If heat is the more grateful, it may be applied in the shape of hot cloths.

In gangrenous cases one may use an irrigation of potassium permanganate 1 to 2,000 before using the saline irrigation.

Sprays of adrenalin of varying strengths have been advised to diminish congestion and afford relief. I have been disappointed in their results.

Alcohol diluted six or eight times used as a gargle is said to be of value.

Touching small gangrenous patches with Tr. Iodine has been mentioned as helpful.

Application of Löffler's solution once or twice a day is a method long pursued.

(Löffler's Solution. Menthol 10; solve in toluol ad 36 c.c., alcohol absolut. 60 c.c., Liq. ferri chlor. 4 c.c.)

I purposely refrain from mentioning many escharotics that have been advised, as I believe their use is fraught with danger.

Nose. Here again cleanliness is the purpose of the measures used and here even more gentleness than in the care of the throat must be exercised. The best solution is, as in the throat, **physiological salt solution** or 2 per cent. **boric acid solution** or a **Dobell's solution** diluted two to four times.

Irrigation, so valuable a measure in the care of the throat, is to be deprecated as a routine in the nose, because of the ease with which the irrigation fluid runs into the Eustachian tube, carrying with it infection to set up otitis media and its sequelæ.

The **spray** is the best vehicle here and, about the anterior nares, most gentle swabbing.

When membrane is present peroxide of hydrogen diluted three or four times may be applied or sprayed before the cleansing spray.

If the condition of the nasal passages is such as to make imperative other measures than the spray, e.g., in young children with profuse persistent discharge, the irrigation may be adopted with extreme precautions. One uses the same cleansing solutions mentioned, directs the patient to keep the mouth open during the whole procedure, which lessens the danger of forcing fluid into the tubes, begins on the side the more obstructed to avoid damming back, holds the irrigator at the least height to just make the fluid pass through, and uses a glass nasal tip or a soft rubber catheter with multiple holes cut in it. Once in four to six hours is often enough.

So good an authority as McCollom advises in membranous rhinitis insufflations of calomel.

A **muco-purulent, sero-purulent** or **serous rhinitis** occurs in 10 per cent. to 20 per cent. of the cases. The turbinates are œdematous, the discharges acrid and excoriating. In the majority of the cases it developes in convalescence, when otherwise the patient is considered cured. Its secretions are highly infectious and responsible for many return cases. The measures of cleanliness mentioned above are used, but recent work with **vaccine therapy** gives encouraging results. The staphylococcus aureus is present in the vast majority of the cases. From cultures of it and other organisms present an autogenous vaccine may be made, or in the absence of these facilities the stock staphylococcus vaccine or bacterin may be used. The initial dose is 50,000,000 to 100,000,000, according to age and condition. The doses may be given twice a week or every fifth or sixth day. Usually three injections suffice for a cure. Slight febrile reactions may be anticipated.

No doubt the sinuses are often involved and a persistent temperature in the absence of obvious cause, such as the ear, should make one think of the maxillary, ethmoid and even the frontal and sphenoidal sinuses, in spite of the late development of these sinuses in the child.

Cardio-Vascular Apparatus. There has been much discussion about the relative parts played by the heart and vaso-motor mechanism in circulatory failure. I interpret the results of such discussions and experiments as follows: that while the myocardium may be the seat of parenchymatous or interstitial change, such lesions are relatively rare and as the cause of death extremely rare. That circulatory failure may be considered as practically always due to vaso-motor failure and that the result of experimentation points to the vaso-motor center as the particular part of the apparatus at fault.

In one group of cases the heart sounds may be clear and strong to the end, bespeaking competency on the part of that organ, when the vaso-motor center has been so impaired as to make the cardiac effort futile. Pallor, cold extremities, a small, empty rapid pulse with a low blood pressure bespeak the condition. In another group, the first sound of the heart may be muffled or almost disappear, or may be split; the pulmonary second sound may be split and accentuated; there may develop a systolic murmur at the apex and the heart may show a tachycardia, bradycardia or arythmia. Yet these signs may not mean and, in the great majority of cases do not mean, any intrinsic change in the heart structure or its functional capacity, but may be explained by that same loss of tone that obtains in the vascular system, and the murmur be one or relative insufficiency of the auriculo-ventricular valves, from relaxation of the rings.

In hearts in which loss of tone occurs, the unsupported thin conus arteriosus feels the effect most markedly and its contact with the chest wall immediately overlying at the second left intercostal space gives occasion to the murmur.

Very slight dilatation may sometimes be made out and in the area of the conus denote its dilatation. The apparent impairment of cardiac action is due to loss of normal resistance ahead in the dilated peripheral vessels.

Theoretically, then, our attention should be directed to the vaso-motor system in particular.

It is our misfortune that we have no drug that can do for the vaso-motor system what digitalis does for the heart.

The drugs credited with effects upon the vaso-motors are caffeine, camphor, strychnine and adrenalin.

None of these are as reliable as we could wish, all are evanescent in their effects, necessitating frequent dosage and to each is denied by many competent men the effect credited to it, if we except adrenalin.

Caffeine is our best reliance in vaso-motor weakness. Its action is complicated and not constant in effect. I quote the authority of Meyer and Gottlieb's Experimental Pharmacology as an explanation for both these statements. Its action, they say, is a combination of the following factors: "1. Stimulation of the vaso-motor centers: Constriction of the arterioles and as a consequence under certain circumstances a rise of blood pressure. 2. Effects upon the heart in a multifold manner: a) Stimulation of the cardiac inhibitory vagus centers; Slowing of the pulse. b) Stimulation of the peripheral accelerating cardiac ganglia: Quickening of the pulse rate; according to the circumstances and to individual factors the one or the other action predominates. c) A change of the heart muscle, whose diastolic capacity decreases and whose systolic energy increases: as a consequence, there is usually a diminution of output per beat and lessening of blood pressure. d) Dilatation of the coronary vessels.

"If the vascular contraction dominates, the result will be a rise of blood pressure above the norm; but if the vaso-constrictor centers are but little excitable or paralysed through some pharmacological agent, like alcohol, then caffeine will bring a fall in the blood pressure as a rule."

In man, in moderate doses, a slowing of the pulse ensues with a diminished output per unit of time. It is only the effect on the vaso-motor centers that dominate the blood pressure that justifies its use. This effect is brought about through the splanchnic vessels. Many other territories, such as the renal vessels and coronaries are dilated. (Sollman.)

Caffeine is best given in the form of one of the soluble double salts of sodium benzoate and caffeine or sodium salicylate and caffeine. It should be given hypodermically or for more rapid action, intramuscularly, in doses of gr. iii to gr. v (0.2 to 0.33 Gm); this is equal to about half the amount of pure caffeine. In a child of five years gr. ss–i (0.030–0.060 Gm); at ten years gr. i–ii (0.060–0.120 Gm). It should be repeated at two hour intervals in urgent cases, for the effect rarely lasts beyond this period. One may anticipate an effect within five minutes, arriving at a maximum within the half hour and amounting to 10 to 20 mm. Hg. It may last two hours, but in my observations often a much less time.

Camphor. This is less reliable than caffeine, but is my second choice. It should be given in doses of gr. iii to gr. v (0.20–0.30 Gm) in the adult and gr. ss to i (0.030–0.060 Gm) in a child of five years, and gr. i to ii (0.060–0.120 Gm) at ten years. It is best given in a solution of 10 to 20 per cent. in olive or sesame oil, hypodermically or intramuscularly and should be repeated every two hours in urgent cases. The results when they are positive are in my observations very like those of caffeine, a rise of pressure in a few minutes, reaching a maximum within the half hour to 10 to 20 mm. Hg. and lasting from forty-five minutes to over an hour.

One may alternate these drugs, each every four hours, thus one or the other every two hours.

Strychnine is the third choice. It should be given in doses of gr. 1/60 to gr. 1/30 (0.001–0.002 Gm) every three hours in the adult and in doses of gr. 1/200 to gr. 1/150 (0.0003–0.00045 Gm) at five years and double this dose at ten years. Personally, I place but little reliance on this drug.

Adrenalin is not appropriate for continued dose. Its effects are prompt and evanescent. It has value in sudden collapse and acts on the vessels themselves, when the center can not respond to stimulation. Its effects vary in the mode of administration.

In my studies I have seen no effects when given by mouth or rectum. The effect is uncertain under the skin; it may be decided and prompt or much delayed and slight or fail. It is more certain when given into the muscle and most certain by the vein. The dose by the skin is m. x (0.65 c.c.); by the muscle slightly less as an initial dose m. vii or viii (0.5 c.c.). By the vein m. ii or iii (0.120–0.2 c.c.). This is the dose for an adult. For the child of five years one quarter the dose, at ten years or twelve years one-half.

There is danger in the careless handling of this drug and more especially in the presence of a weak heart. I have seen in an adult, moribund, a dose of m. vii (0.5 c.c.) into the vein shoot a pressure of 60 to 70 mm. to 230 mm. faster than it could be taken. Such strains on the heart may cause a failure on the part of that organ.

Alcohol I believe to be a depressant and condemn.

Digitalis. But let us suppose that there is no improvement in the circulatory condition in response to these measures. Shall we use digitalis? I should say decidedly yes. It must be granted first, that if the heart is not impaired it is questionable whether digitalis can enhance its functions; but even though the chances of its impairment are statistically small, there is still the possibility that it is to some degree and may be helped by digitalis; second, that its effect on blood pressure through its action on the vaso-motor apparatus in man is in doubt, but still that it has such an action in animal experimentation is accepted, and the benefit of the doubt should be given in serious cases; third, that its effect on the heart is lessened in fever, e.g., the inhibitory action of the vagus enhanced by the drug may be set aside in fever, because under the influence of the toxins, the inhibitory action is said to be lost in part or whole. In the presence of so much doubt our anticipations must be tempered, but it seems to me that any drug which under other circumstances has so decided an effect to improve a faltering circulation, should not be left untried because of theoretical considerations.

The action of digitalis is slow, however administered, and if we are accepting it as an agent to be used, it must be begun before the condition has become dire. I feel that it may well be begun when frank evidences of failing circulation set in as an adjuvant to the vaso-motor stimulants mentioned.

The dose in an adult should be ℥ss (15 c.c.) of the infusion t.i.d. or 4 i.d.; that is, the equivalent of 14 grains (1 Gm). Any official preparation may be used in equivalent doses. It must always be prepared fresh from a fresh green leaf. Such doses may be kept up for 12 to 15 doses.

For very rapid effects, **strophanthin** may be used in doses of gr. $\frac{1}{120}$ (0.0005 Gm) into muscle or vein, with the anticipation of a digitalis effect beginning within the hour. Such doses should not be repeated except with caution, in less than twelve hours. Digitalis may be begun at once in the above doses, as its effects will be delayed for some thirty-six hours.

For the child of five years give about one quarter this dose of digitalis or strophanthin.

Cold in the shape of packs or cold air with proper precautions of bed making have excellent results on the circulation. See Open Air Treatment. (Pneumonia, Chap. IV.)

Nervous Symptoms. These depend upon the severity of the attack. In moderate grades of the infection there may be some stupor, but in the more severe, delirium of the active type or a low muttering delirium.

There is nothing better for the cerebral manifestations of the toxæmia than **cold water** as described under the treatment of hyperpyrexia, in the shape of packs, sponges or baths.

An **ice-cap** applied to the head has a sedative effect.

If there is much restlessness **bromides** may be used, gr. iii (0.20 Gm) to gr. v (0.30 Gm) three or four times a day in children, gr. xv to gr. xx (1–1.30 Gm) in adults. Sodium, or potassium salts may be used or equal parts of sodium, potassium and ammonium.

Small doses of phenacetin, gr. i to gr. ii (0.060–0.120 Gm) at four hour intervals may be given to children, but the temptation to use drugs instead of such measures as hydrotherapy must be combated.

Sleeplessness. For milder grades, the effects of the **baths** are often sufficient. Instead of the cold bath, **sponging** with warm water may prove more sedative.

The small doses of **bromides** or **phenacetin** advised may prove effectual. In adults, **trional,** gr. x to gr. xv (0.60–1 Gm) to be repeated in two or three hours, if necessary, or **chloralamid,** gr. xx to gr. xxx (1.30–2 Gm) to be repeated in the same time if not effectual.

For **wild delirium,** sacrificing sleep and rest and imperiling the patient by the exhaustion provoked, **morphine** must be given, in the smallest dose effectual. In the adult gr. $\frac{1}{8}$ (0.008 Gm) hypodermically to be repeated in two or three hours if needed, in the child of six, gr. $\frac{1}{48}$ to gr. $\frac{1}{24}$ (0.0015–0.003 Gm).

SERUM AND VACCINE THERAPY

The achievements of modern medicine in **serum** and **vaccine therapy** naturally turn our minds to these fields in the consideration of so dire a malady as scarlet fever. As yet neither of these methods have yielded satisfactory results in this disease. This will be readily understood when we consider that the agent of scarlet fever is not yet known and that streptococcic infections during the acute stage are but little amenable to vaccines. With regard to vaccines we may quote the statement of Weaver in Musser and Kelly's *Practical Treatment* that after a considerable experience with vaccines he concludes that their use early in scarlet fever does not stay the usual complications but that they are useful in the treatment of the subacute and chronic stages of some of the streptococcus complications of the disease.

A polyvalent **streptococcus serum,** in the production of which some thirty types of streptococci obtained from scarlet fever cases have been used has been tried in the Annaskinderspital in Vienna since 1902 with gratifying results. This is known as the Moser serum.

The statistics in this hospital are quoted as 8 per cent. against 13 per cent. in the other hospitals of the city. Such results would seem extremely satisfactory, for the gain must logically be attributed to the successful combating of the streptococcus toxæmia. The Moser serum has never been obtainable in this country, which is regrettable considering the long and satisfactory usage in so reliable a service.

In this country a polyvalent serum from different sources has been used, e.g., that of the New York Board of Health, but with no such gratifying results.

Personally, I am inclined to use the polyvalent serum from such reliable sources, because, in the absence of any known harm, I feel, in desperate cases, the patient should be given the benefit of the doubt.

The quantity used depends on the make and is specified in each instance.

Otitis. So frequent a complication is otitis in scarlet fever that the possibility of its onset should not be forgotten from the day the case is taken in hand. The frequency varies in different epidemics and has decided relation to the severity of the throat symptoms. In large bodies of statistics the incidence of the complication has been set at figures varying from 10 per cent. to 33 per cent., while in cases that may be termed severe the percentage runs to 50 per cent. and 75 per cent.

It should be laid down as a cardinal rule that the ears should be examined daily with the otoscope. Few simple procedures repay the effort expended on them comparable to otoscopy. The small size of the auditory canal in the little patients and the difficulty of determining landmarks discourage many practitioners in making the effort. Of very great assistance are the magnifying otoscopes with electric light attachment, easily portable with a small battery. These instruments bring out the field with remarkable distinctness.

This examination becomes the more imperative when one appreciates that the condition may occur without pain and the first premonition of its existence be determined by a discharge. Before this discharge appears, however, opportunity for a spread into adjacent structures has been given and the rupture of the drum may sacrifice the integrity of that structure beyond repair. Again, patients who are very ill or who are delirious may not voice the pain and discomfort they feel and thus give no clue to the condition.

As a prophylactic measure I would reiterate the warning given in considering the care of the nasal passages, that irrigation may induce the otitis and if the state of the nasal passages seem to demand the use of an irrigation, it must be done with extreme care and with the patient's mouth open.

With appearance of bulging of the drum, congestion and reddening of the drum, a loss of lustre and macerated appearance of the drum, an **incision** is indicated. To the general practitioner a detailed description of the drum appearances that do or do not indicate paracentesis is often confusing. It seems to me that a decided deviation from the normal in the appearance of the drum and especially if accompanied by pain in the ear and a rise of temperature ought, in a disease in which the sequelæ of otitis are so serious, to demand immediate interference.

Technique. The external auditory canal should be cleansed first with cotton on an applicator with 1 to 1,000 bichloride. A curved bistory or a paracentesis knife is used. The incision should begin posteriorly and below at the end of the malleus, sweep upward along the edge of the drum to Shrapnell's membrane, through it and out along the upper and posterior wall. Do not use wicks and drains or pack the canal tight with cotton.

Irrigations should be instituted every 2 hours by day and every 4 hours by night with 1 to 5,000 bichloride of mercury or with boric acid solution, 2 per cent. to 4 per cent. A pint should be used, from an irrigator or fountain syringe held 2 to 2½ feet above the level of the ear. As the ear improves, the frequency may be decreased to every 4 or 6 or 8 hours.

In irrigating a child's ear the ear should be drawn down and back; in an adult up and back.

With a skilled hand the pain is but momentary though intense; a whiff of chloroform or ether may be given or ethyl chloride and the incision done during the primary stages of anæsthesia.

For the **pain** of earache, **dry heat** is the best application. This may be afforded in the shape of a **hot salt-bag,** a **hot water bottle** or **hot plate.** Irrigations and instillation are to be deprecated, because the maceration ensuing blinds the landmarks and makes both the examination and incision more difficult. If, however, the pain is not relieved in this manner, one may try a device advised by Yeo. Heat a large sized wine-glass with hot water; pour this out and then into the hot glass place a pledget of cotton, pouring on this 10 to 20 drops of chloroform and then apply the whole closely over the ear, or **carbolic in glycerin** 5 per cent. gtt. ii–iii.

If irrigations must be used, use first simple hot water, then 4 per cent. **cocaine.**

The natural course of the discharge in older children and adults is one to two weeks, but much longer in young children. In these, however, it usually ceases within twelve weeks.

After the drum is incised, a cessation of discharge with a rise of temperature, pain over the mastoid or swelling there denotes an implication of that structure; but swelling may be absent, pain or tenderness slight and the discharge profuse and yet the mastoid involved.

A rise of temperature, not otherwise accounted for, should lead to strong suspicions of the mastoid and surgical advice and interference sought. Involvement of the sinus, of the meninges and the brain are all possibilities that keep us awake to the slightest signs of the same with a view to expert opinion and surgical intervention.

It must be remembered that these discharges are highly infectious and should be treated with 1 to 20 carbolic or 1 to 1,000 bichloride and what can be burned should so be disposed of.

Vaccines. The very fact that these discharges are so infectious; that they detain the patient in the hospital so long; that in the end a small per cent. must be released on the supposition that the discharges are no longer infectious, only to demonstrate that the supposition is not always correct makes any treatment that has theoretical promise welcome.

Good evidence is forthcoming that the recently developed vaccine therapy is fulfilling this theoretical promise to some degree. This is not the place to cite the literature at length on the subject, but an extremely instructive consideration of this subject will be found in an article in the *Journal of the A. M. A.,* April 11, 1911, by Weston and Kolmer, entitled "The Treatment of Suppurative Otitis Media (Scarlatinal) by Bacterial Vaccines (Bacterines)." Their conclusions were "that the best time, all things considered, for commencing vaccine treatment in cases of otitis media, is from the eighth to the sixteenth day of the discharge," thus agreeing with nearly all observers, that the subacute stage is that in which the most favorable results ensue. "That continued high fever, nephritis, toxæmia and various intercurrent affections are contra-indications to the administration of vaccines." "That under vaccine treatment, three times as many patients are cured within thirty days and permitted to go home as under the usual treatment. This means that the average residence of the patient in the hospital has been considerably reduced."

The organisms most commonly met are staphylococcus aureus and albus, bacillus pseudodiphtheriæ, streptococcus pyogenes and bacillus pyocyaneus.

The vaccine should be autogenous and one finds that recultures do not always show the same organism or show additional organisms. The staphylococcus is often found early, a week later the bacillus pseudodiphtheriæ often intrudes and as a still later comer, as in many suppurative conditions, appears the bacillus pyocyaneus; hence, the value of recultures and fresh vaccines. The initial dose depends on the organism, being small with the streptococcus, 5,000,000 to 10,000,000, larger with the staphylococcus, 20,000,000 to 50,000,000, and a little more with the others mentioned. The doses should be administered twice a week or every 5 or 6 days. The increase depends on the reaction. The reaction is (1) general, a slight fever.

(2) Local; an increase in the discharge. (3) With some organisms, such as the streptococcus, a local redness at the site of injection It is desired to increase the dose so that little or no reaction occurs.

The ear should not be syringed or medicated during the treatment, as, in the lighting up of the process, as a part of the reaction, a spread into adjacent structures is facilitated by the syringing.

The most cases are cured within five or six doses; a few may require a dozen and a very few more.

Adenitis. A certain amount of involvement of the lymphatic glands always occurs and especially of the cervical glands.

When the angina is severe the adenitis may be very marked. Usually, however, this inflammation of the gland that occurs at the height of the fever subsides without suppurating. Curiously enough the serious involvement of the glands is a late manifestation, occurring during desquamation, most commonly in the third or fourth week or even later, and, indeed, may occur in the same glands which, enlarged during the period of maximum intoxication, had resolved. Those at the angle of the lower jaw are particularly affected. It is this adenitis that so frequently goes on to suppuration. Whenever a temperature occurs during convalescence this is the one territory the involvement of which must be kept in mind.

Cold. The best application to be made at once is cold in the shape of **ice** in the ice-bag or bladder-skins. There should be a layer of flannel between the ice and the skin. Direct contact or too long contact may damage the skin.

While remaining skeptical about the value of drugs locally applied, my choice is for **ichthyol,** painted on pure or in the shape of a 25 per cent. ointment.

There is a difference of opinion about the value of hot applications, such as poultices. My own feeling is that it is useless and looks away from good surgical practice.

At the very first sign of **suppuration, incise.**

The glands may not suppurate, but become gangrenous, the tissue overlying breaking down; or there may be a great deal of periadenitis and cellulitis with brawny induration.

There is a difference of opinion about the advisability of incision in these cases. Such brawny masses will often resolve, but if the toxæmia is increasing and the process spreading, free incision into the tissue should be made.

Arthritis. An arthritis, a so-called scarlatinal rheumatism, occurs in about 4 per cent. of the cases, coming on as a rule in the second week of the attack. In the majority of cases it may be classed as a toxic arthritis; in rare instances it is a septic process.

It resembles the gonococcal type of arthritis rather than that of true rheumatism, affecting the small joints of the fingers and wrists, as well as the large ones. There is as a rule only slight swelling and redness; rarely an effusion of serum, very rarely pus. It lasts as a rule only three or four days, exceptionally a week.

It may be treated on the same principles as the arthritis of rheumatism (see Rheumatic Fever, Chap. III), namely, **rest** to the joint, by splints or other devices, pillows, folded blankets, local applications of **ice,** or a snug bandage if there is effusion; if not, **methyl salicylate** painted on and the joint wrapped in a thick layer of cotton batten and the internal administration of **sodium salicylate** or other form of salicylate, such as aspirin, salicin, oil of wintergreen, be begun in doses of gr. x (0.60 Gm) every two hours to a child of ten years or twelve years, half the dose at five years, and gr. xv to gr. xx (1–1.30 Gm) in adults. This may be given with or without alkaline salts. If with, give sodium bicarbonate in double the doses of the salicylates, until the urine is alkaline and then diminish the dose gradually, just keeping the urine alkaline.

As the symptoms subside lessen the dose.

If the joints suppurate they must be treated on surgical principles. Aspiration under surgical precautions should determine the presence of the suspected pus. The joint may then be aspirated through a canula and thoroughly irrigated with sterile salt solution. It may be well to inject a half ounce of 10 per cent. formalin in glycerin. If the joint does not resolve under these procedures it should be opened.

A **myositis** may occur instead of the arthritis, most commonly a lumbago. This is to be treated locally and by internal medication like the arthritis.

Nephritis. Scarlatinal nephritis adds much to the dread in which scarlet fever is held, not only because of the immediate danger entailed by it, but also because of the haunting possibility of the insidious development of a chronic process, it may be, long after every indication of kidney damage has passed and because its onset comes at the time when we are beginning to congratulate ourselves on a happy convalescence.

During the height of the fever a slight albuminuria, such as one may get in any acute infection, from acute degenerative processes of no lasting or important significance in the parenchyma occurs. This need give little alarm, but the appearance of albumin at the end of the third week or the beginning of the fourth has a different meaning.

Every day throughout the continuance of the infection and even more imperatively throughout the convalescence the urine should be examined for albumin. It is well to have the paraphernalia for the simple heat and acetic acid or the cold nitric acid test in the sick room or bath room and do the test at each daily visit.

We must keep in mind, too, that a mild attack can in no way warrant the assumption that nephritis and severe nephritis will not occur. In fact, there seems to be a dissociation in the degrees of severity of the attack and the onset of the nephritis.

We know that the severe form of nephritis is most common in the second lustrum and that the appearance of albumin in children after ten is more likely to be an albuminuria simply; hence, redoubled vigilance in the younger children.

Nephritis is said to occur in 10 per cent. of the cases.

Treatment really begins with the beginning of the attack for we believe that the efficiency of the nursing, care in the diet, a sufficiency of water ingested, especially care of the mouth, firmness in keeping the patient in bed during the convalescence, avoidance of draughts upon the patient's back, all tend to make the incidence of the nephritis much less.

The type of the nephritis is a glomerular nephritis. Its onset may be insidious or abrupt. Everything is going nicely in convalescence when suddenly an attack of vomiting, a rise of temperature or in rarer instances a convulsion tell of the onset; or the daily examination is rewarded by the first indication in terms of albumin, casts and blood.

With the more insidious attacks a dropsy develops; in the more fulminating cases uræmic manifestations. The urine is diminished. Fortunately the vast majority of those attacked recover, the urine becomes normal in amount in about ten days and becomes free from blood and albumin in two to six weeks.

In all cases of acute nephritis certain definite lines of action are to be pursued.

1. **Rest the kidney, by utilizing other organs to perform its functions vicariously in some measure and add as little as possible to its burden by the proper arrangement of dietary.**
2. **To treat the symptoms that cause distress or danger.**
3. **To support the strength of the patient during the attack.**

To consider the last first, this object is attained by a more rigid definition of rest, if the rules have been relaxed in beginning convalescence; by using blankets on the bed and a flannel night-gown, if one is not already in use and by giving the warm sponge bath between the blankets with a renewal of the precautions taken earlier in the illness.

Diet. If the onset is explosive with nausea, vomiting and fever and with anorexia, no food should be offered until the gastric symptoms subside. During this time cracked ice may be given to mitigate the nausea and vomiting and furnish some water to the tissues. If there is suppression or marked oliguria, only water with sugar and fruit juices, the sugar affording some food value, should be given and it should be remembered that if the kidney has lost its function for eliminating water and is even shunting it into the tissues to the production of anasarca, the ingestion of large quantities of water will only add to their burden. The amount of water should be increased as the increased water output betokens a restoration of function.

We may then begin to give milk in increasing quantities. Our problem from this stage on is to approximate in the diet the caloric needs of the body by a food that shall offer the least amount of work for the kidneys.

We may give milk, with some cream if well borne, rice, arrowroot, corn meal or oat-meal gruels, bread or zwieback and butter and sugar.

Van Noorden has suggested as a suitable diet in an adult 1,500 grams of milk (1½ quarts), 375 grams of cream (12 oz.), 50 grams of rice, 50 grams of butter, 20 grams of sugar, which has a heat value of 2,900 calories, as much as that in over 4 quarts of milk. In a child of twelve the demands are less, some 1,600 calories, and the cream should be used much more sparingly.

The kidney eliminates water, salts and nitrogen. Such a dietary is economical in all these substances, considering its high caloric value.

If there is œdema, all the articles taken should be salt free, salt free bread and butter and no salt added to the gruels. Milk contains one and one-half grams of salt to the liter and enough for the metabolic needs. If the œdema continues still, cut down on the quantity of fluid. I have seen an œdema kept up simply because the intake of water was forced beyond the powers of elimination of a kidney in the process of resolution.

Drinks. Water in large quantities is often advised as a sort of a panacea. When œdema is present it should be much limited. The blood will recover water from the œdematous tissues to meet its needs. When the kidney begins to eliminate freely, a freer intake of water will be followed by a diuresis and in uræmia without œdema this may be a desirable means of effecting it. There is rarely danger in giving water enough to meet the demands of the patient's thirst. Plain or **aërated water, mineral waters, lemonade, orangeade** or **imperial drink** may be used.

As convalescence is established other cereals, vegetables, and lastly fish and meat may be added.

Rest to the kidney is afforded, as shown by the choice of the dietary and is further accorded by the assistance lent in elimination by the other emunctories.

Purgation. One of these emunctories is the intestine. The movements should be rendered watery and fairly copious by the use of salts, such as **Rochelle salts, Epsom salts** or **Sodium phosphate,** in doses of ℥ss to i (15–30 Gm) in adult and half the dose to the child. Compound **jalap powder** is also of use, especially in the adult in doses of ʒi (4 Gm). It must be remembered that purgation may be carried to the point of exhaustion and do more harm than good.

Diaphoresis. The second great emunctory is the skin.

To effect copious sweating perhaps the best measure is the **hot pack.** They can be given once or twice a day, depending on the urgency of the attack. The whole procedure lasts about an hour. During the pack water is given and ice kept at the head.

Another procedure is the hot-air bath, to which some patients respond better than to the pack.

Another procedure is the hot bath, beginning at 95° F. and slowly increasing the heat to 100° F. This is kept up for ten or fifteen minutes, then the patient wrapped in a dry or hot moist blanket or pack and continued for another half hour.

It has been again and again noted by clinicians that the hot pack in the œdematous has seemed to precipitate an attack of uræmia. Close observation must be kept upon the patient for any evidence of the same, headaches, twitchings, nausea and vomiting or hypertension.

Drugs. Pilocarpine has been used and will usually induce a marked diaphoresis. It is, however, fraught with dangers, the most imminent of which is œdema of the lungs, and may well be dispensed with.

Treatment of symptoms that cause distress or danger.

The congestion of the kidneys as evidenced by diminished urine or at times by lumbar pain.

Cupping. Two or more cups may be placed over the kidney region on either side and left on for 15 to 20 minutes or until the capillaries are well dilated. (For technique of cupping, see Pneumonia, Chap. IV.)

Wet cupping or the application of leeches is advised by some authorities. I am not convinced that the letting of blood here relieves congestion in the kidneys better than venesection elsewhere. So far as the withdrawal of blood relieves the circulation in the presence of hypertension or uræmia, these measures do good. (For the technique of wet cupping and leeching, see Pneumonia, Chap. IV.)

Such good as these measures do I believe is to be referred to reflex processes, starting in the skin area operated on and impinging on the deep vessels.

Counter-irritation. For this purpose hot poultices, mustard paste or hot fomentations may be used. (For the technique of applying poultices, fomentations, mustard paste, see Pneumonia, Chap. IV.)

Diuretics. When the acutest stages have passed, we may venture to encourage diuresis by the mildest of diuretics, milk and water, and the drinks mentioned. These may be followed by the alkaline salts, the **citrate of potash,** the **acetate of potash** or

bicarbonate of potash or sodium in doses of gr. xx to xxx (1.30–2 Gm) every two or three hours, or half that dose in children until the urine reacts alkaline, then reduce until an amount is continued just enough to keep the urine alkaline. These alkaline salts are often mixed in equal parts.

A little later one may use the double salt of sodium salicylate and theobromine or **diuretin** in doses of gr. v to gr. x (0.30–0.60 Gm), according to age, three times a day or, if any concern is felt for the effects of the salicylate on the kidney, a concern in which I do not share, one may use **agurin,** the double salt of sodium acetate and theobromine, in the same doses.

If the heart is weak **caffeine** in the form of the soluble double salts of sodium benzoate and sodium salicylate gr. iii to v (0.20–0.30 Gm) three or four times a day or gr. i to gr. ii (0.060–0.120 Gm) in a child of five years. Caffeine has a selective action of the renal vessels causing dilatation, facilitating blood supply and diuresis. If the heart, however, is a factor in the condition, increasing congestion of the kidney, by its own decompensation, digitalis is emphatically indicated and is to be used as described under the cardio-vascular apparatus.

Œdema is as a rule not massive and is relieved by the measures already mentioned. It is possible, however, for fluid to accumulate in the subcutaneous tissues and in the serous sacks to a degree demanding immediate interference.

If the hydrothorax is sufficient to embarrass either the circulation or respiration, it should be removed by a **paracentesis.**

The same procedure must be undertaken for ascites, if the fluid in the peritoneal cavity embarrasses respiration or cardiac action.

Uræmia. With the first premonition of uræmia one should have recourse to vigorous **purgation** and **diaphoresis.** With hypertension, twitching foretelling convulsions, **venesection** is indicated, the amount depending on the age, 10 to 16 ounces in the adult, 3 to 6 in a child of five years. This may be followed by a **saline** infusion of twice the amount taken; but is not imperative in the stronger patients.

The muscular twitching demands sedatives, **chloral,** given by the rectum in a couple of ounces of warm milk, gr. xxx to ʒi (2–4 Gm) in the adult, gr. v to gr. x (0.30–0.60 Gm) in the child of five to six years.

This can be repeated in a couple of hours if needed.

Convulsions. The one drug efficacious at the moment is **chloroform,** continued until the attack ceases. This is followed at once by a hypodermic of **morphine** to prevent recurrence, in the adult gr. 1/4 (0.015 Gm) and repeat in a half hour if needed; in the child gr. 1/24 (0.0025 Gm) and in an hour gr. 1/48 (0.0015 Gm) if needed.

An **enteroclysis** of normal salt solution, two quarts at a time and several times a day, given at 104° F. to 108° F. acts often as a vigorous diuretic and assists in elimination of the toxic agent.

With hypertension, amelioration of the condition may follow upon the administration of **nitroglycerin,** gr. 1/100 to gr. 1/50 (0.0006–0.0015 Gm) q. 2 h. in the adult or gr. 1/200 (0.0003 Gm) every hour for five or six doses at five years.

Headache is best relieved by an **ice bag** to the head or the nape of the neck. Small doses of the milder coal-tars may be used cautiously, **phenacetin** gr. i to gr. iss (0.060–0.10 Gm) every hour for three or four doses in the child; gr. v (0.30 Gm) at a dose in the adult.

Lumbar Puncture. Recurring convulsions or excruciating headache may find relief in a lumbar puncture, a comparatively simple procedure in the child. (For technique, see Cerebro Spinal Meningitis, Chap. XVII.)

Nausea and Vomiting. This is an expression of uræmia and will improve with the elimination of the causative agent. For immediate help, we **stop** all effort at **food** administration, give **cracked ice,** apply a **mustard paste** to epigastrium of one part of mustard to four, five or six of flour, depending on the sensitiveness of the skin, mixed with cold or tepid water and leave until the part is reddened, or give internally **bismuth,** gr. x to gr. xv (0.60–1 Gm), **bicarbonate of soda,** gr. v to gr. x (0.30–0.60 Gm), or **oxalate of cerium,** gr. ii to gr. v (0.15–0.30 Gm), or they may be combined, as

Bismuth subnitratis	15.	℥ss
Sodii bicarbonatis	10.	gr. cl
Cerii oxalatis	5.	gr. lxxv

M. et Div. in chart. no. xv.
S. One every two hours in a little water or food.

Rare complications in the course of the nephritis, such as pneumonia, pleurisy, endo- or pericarditis must be treated as if primary. Œdema of lungs occurs as a cause of death in nephritis.

Anæmia is a striking feature of a nephritis. In convalescence **iron** is indicated. It may be given as **Blaud's pill** or **Vallet's mass** in doses of gr. iii to gr. v (0.20–0.30 Gm) three times a day or as **Basham's mixture** or Liquor ferri et ammonii acetatis, which contains 4 per cent. Tr. ferri chloridi, converted into acetate. Dose ʒi to iv (4–8 c.c.) three times a day.

Convalescence. After an acute attack great care must be taken to prevent a recurrence by too early exposure. The patient should remain in bed until albuminuria ceases or for four or five weeks. If the albumin persists after that, one must consider the depressing effect of too long confinement to bed and the patient be allowed to sit up tentatively, the albumin, casts, total quantity and specific gravity being carefully noted with each increase of license.

If the condition is not aggravated, the patient may be allowed about the house or out of doors in suitable weather; but with the slightest indication of recurrence should be put to bed again. If the evidences of nephritis continue and the patient is able to take advantage of a **change of climate** he may be removed to such a place as allows much out of doors life.

Woolen underclothing must be worn and outer clothing carefully adapted to the weather. Warnings against remaining in wet clothes and undue exposure to the weather must be reiterated. On the occasion of any acute infection the kidneys should be watched with especial care. From time to time, for years after, the urine should be examined at intervals of 3 to 6 months to appreciate the insidious advance of a chronic process.

The sum total of prophylaxis is after all the observance of the laws of hygiene, clean bodies, fresh air, good food and right living.

The Heart. Mention has been made of the heart in considering the cardio-vascular apparatus and its part in nephritis has been touched upon; but in addition to these there may rarely be an endocarditis (in something less than ½ per cent.) and still more rarely a pericarditis; this latter usually in septic cases.

The treatment of these conditions are the same as under other circumstances, **rest,** the **ice bag,** and if the myocardium becomes involved and shows signs of weakening, **digitalis.**

Broncho-Pneumonia is likely to follow upon septic cases, but may more rarely happen during desquamation. It is a far less serious complication than in measles or whooping cough.

The treatment is as elsewhere. (See Pneumonia, Chap. IV.)

Pleurisy occurs not infrequently and occasionally, early or late, an empyema, always a grave condition, demanding prompt operative interference. (See Pneumonia, Chap. IV.)

Still more rarely one meets **noma.** It is to be combated by **curetting** and the application of **fuming nitric acid** and if this fails to stop its extension, **excision** must be done. McGuire advises application of thick paste of bismuth subnitrate and water. Chorea, peritonitis, symmetrical gangrene and other very rare happenings are to be met as under other conditions.

Relapses. Relapses may occur, as often, it is said by some authorities, as 1 per cent. It is most usual in the fourth or fifth week, but may be delayed until the sixth or seventh. It is in all particulars like the original attack and is to be treated in the same manner.

Recurrences are possible, usually many years later, but are very rare.

Discharge of Patient. The patient should not be released from isolation until desquamation is completed and all discharges from the mucous membranes or suppurating tissues, organs or structures cease.

Even in the mildest cases, however soon the desquamation may seem complete, the patient should be isolated at least four weeks and six weeks is safer. In fact the average case has to be isolated for this time. But even then, if the desquamation is not complete (and the feet have especially to be attended to) isolation must continue. It is to be remembered, as before mentioned, that harsh measures to effect desquamation may set up a dermatitis and defeat the purpose. If, however, when desquamation is quite at an end, there is a discharging nose, ear or gland, the patient must not be released until this ceases.

When all symptoms have ceased and the patient is released from quarantine, if a child, he should not mingle with other children for a month to come nor sleep with them for three months (Holt).

When the child is ready for **release** he is given a thorough soap and water bath and then one of carbolic 1 to 50 or bichloride 1 to 5,000. The scalp and hair are thoroughly shampooed.

No more excellent guide for routine procedure can be taken than Northrup's description of that in use in some of the New York Hospitals. (Nothnagel's *Encyclopedia of Practical Medicine,* 1902, English Translation, 611, quoted from Weaver in Musser and Kelly's *Practical Treatment.*) "During the week preceding discharge patients have their ears irrigated with bichlorid solution 1 to 8,000[1] and the scalp shampooed on alternate days." When discharged

"(1) The ears are irrigated with bichloride solution 1 to 8,000;
(2) the scalp is shampooed with soap and water;
(3) the scalp is shampooed with bichloride 1 to 2,000;
(4) a tub-bath is given of soap and water;
(5) a tub-bath is given of bichloride solution 1 to 8,000 for twenty minutes;
(6) a sponge-bath is given of bichloride solution 1 to 2,000;
(7) the bichloride is sponged off with sterile water;
(8) a nasal spray is given of bichloride solution 1 to 8,000;
(9) the mouth is cleansed with saturated solution of boric acid."

The child is then taken into a clean room and clothed in clean clothes.

Fumigation and Sterilization. Washable clothing should be disinfected by steam or by boiling an hour. Mattresses, heavy blankets, pillows and articles that can not be washed should be steamed where it is possible to have recourse to a properly constructed plant.

All articles that have little value should be burned and toys certainly. No child should ever be given a toy once in the sick room, no matter how sterilized.

Metal objects may be immersed in strong carbolic acid. The room should be cleaned by having the floors, woodwork and the smooth walls washed down with cloths wrung out of 1 to 2,000 bichloride solution. Then the room should be fumigated with sulphur or formaldehyde. These gases should be generated in the presence of moisture to be effectual.

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[1] This in cases in which there may be no otorrhea.

Sulphur destroys many fabrics and injures other articles and is less effectual than formaldehyde. Where it is possible skilled assistance should be sought in this important procedure; where this may not be obtained, the room is to be sealed with strips about the doors and windows, the key holes plugged and formaldehyde gas generated by some of the contrivances on the market. Candles are made for this purpose, but too implicit faith in their efficacy must not be granted. They should be burned in the presence of moisture, such as may be obtained from a dish of water over an alcohol lamp, and the room sealed for some twelve hours.

Such fumigation does not excuse one from the duty of repapering, repainting and recalcimining this room.

SUMMARY

Incubation.

Two to four days. Ten to twelve days.
Period of isolation of those exposed should be three weeks.

Onset and Diagnosis.

Vomiting, fever, sore throat.
Erythematous eruption (twelve to twenty-four hours after onset).
Throat shows bright injection.
Tongue shows hypertrophied papillæ at tip and edges.
Leucocytosis and polynucleosis.
Later.
  Desquamation.
  Eosinophilia.
  Nephritis.

Distribution of the Family.

Adults. Those who have not had Scarlet Fever should come in contact with the patient as little as is compatible with their duty. All adults should avoid contact with children outside. If contact with children outside is imperative, adults should remove from the environment of infection during its course.

Other children of the family.
  Removed to another house, until end of illness.
  Kept from contact with other children for three weeks.
  Should not go to school for three weeks from beginning of isolation. Should not go to school at all during patient's illness, if there is any communication between them and members of the family in contact with the patient or from the home of the patient.
  If it is not possible to remove the children to another house, avoid direct or indirect contact with patient.

Sufficient air space. Good ventilation. Light. Top floor excellent.

Nearness to a bath-room desirable.

Affording ingress and exit without passing through family apartments desirable. Approach through balcony or verandah for example.

Open fireplace a convenience.

Strip room of furniture, carpet, adornments.

Floor bare or covered with carpet lining and over this unbleached muslin.

Room.

Sealing doors, except those in use.

Entrance to all rooms protected by sheets.

One sheet on outside of doorway attached to top and right side. One sheet inside of doorway attached to top and left side or vice-versa.

Floor and woodwork.

Rubbed from time to time with 1–1,000 bichloride of mercury (burn the cloths used).

If the floor is covered sprinkle with same solution.

The nurse.

One for day and one for night or one with a member of the family. If member of family must be nurse, she must be isolated from the rest of the family. She should wear gown and cap.

Handling secretions she should wear rubber gloves.

She should use an occasional throat spray of a mild antiseptic, 2–4 per cent. boric acid solution, or half strength Dobell's solution. Must not come in contact with other members of the family or susceptible people outside. Should not sleep or eat in the sick room.

Should have own room adjacent.

Should take air and exercise. Should change clothes in going out and if coming in contact with others should wash hair.

The physician.

Leave overcoat and coat and vest in bathroom.

Don gown, long and tight at wrists. Failing this a sheet.

Failing this wear overcoat and street gloves, cap, rubber gloves. Wear rubbers, and turn up trousers.

Leave all instruments in sick room or bathroom (including stethoscope). Disinfect before using again.

Visit as short as compatible with proper examinations.

On leaving. Wash face and hands with soap and water.

Follow with alcohol or bichloride of mercury 1–1,000 or phenol or lysol 1 per cent.

A careful physician will change his clothes and take a bath before seeing other children. At least plan to see Scarlet Fever cases either early or late in the day. Spend some time later in the open air, and do not visit a child immediately.

Do not take an obstetric case.

Precautions in the sick-room.

Thermometer. Leave the thermometer in the sick room always.
  Keep it in 2 per cent. to 5 per cent. phenol solution.
Tongue depressors. Should be of wood or glass; better wooden ones.
  Keep glass in phenol solution 2 to 5 per cent.
Syringe nozzles. Glass (not to be used for young children).
  Hard rubber.
  Keep in phenol 2 to 5 per cent. solution.
Dishes, knives, forks, spoons, etc., boiled for half an hour or more.
  If sent out of sick room to boil, soak in 5 per cent. phenol half an hour.
Urinals, bed-pans, sputum cups, rectal tubes; disinfect and allow to stand in 1–20 phenol.
Bed-linen, night dresses, towels, handkerchiefs, etc.
  Soak over night in 2 to 5 per cent. phenol, then boil for half an hour before sending to the wash.
Discharges from mouth, nose, ears caught in pieces of gauze or cloth and burned.
Domestic pets excluded.
Books, toys, etc., destroyed after illness.
Temperature of room.
  Cold air desirable if the body is well protected.
  When body is exposed for any purpose temperature should be at 70° F.
Bed.
  For technique of bed-making see Chap. IV.

Patient.

Keep in bed no matter how mild the case may be, especially on account of the kidneys.
Sponge bath with tepid water daily. In a warm room, under a blanket, exposing one part after another.
Nightgown.
  Should be flannel or cotton or silk undervest under the flannel nightgown.

Diet.

For fundamental principles see Chap. I.
Do not push feeding in first few days.
Milk.
  Milk has proven empirically to be the best article of diet in scarlet fever. Two quarts of milk equal 1,280 calories; adding 1 ounce of cream and ½ ounce of milk sugar to each glass of milk increases the caloric value to 2,000.
  Milk modifications, such as koumys, buttermilk, whey, may be substituted in part or in whole.
Cereals and cereal gruels, arrowroot, rice, barley, cornstarch, wheat flour, farina, imperial granum, jellies of barley flour, tapioca, sago. Vanilla ice cream.
Feed at two hour intervals. Do not interrupt sleep at night.
For caloric values see text.

- After the period for nephritis has passed, add eggs, custard, potatoes, other vegetables, oysters, fish and finally meat.
- Give no meat soups.
- Drinks.
  - Water freely.
  - Lemonade, orangeade, juice of grape-fruit, grape juice.
  - Imperial drink (cream of tartar, a tablespoonful to 3 pints of boiling water, add sugar and lemon juice to suit taste).
  - Give 2 quarts or more of fluid a day.
  - Offer water every hour.

Care of skin.

- Sponge bath with tepid water once or twice a day.
- Itching and burning.
  - Cocoa butter.
  - Cold cream.
  - Sponge with sodium bicarbonate ʒi–Oiii (4 Gm–1,500 c.c.).
  - Bran bath. Handful of common bran in a clean cloth or muslin bag, swished about in 1 gallon (4,000 c.c.) water until slightly milky.
  - Calamine ʒi (4 Gm) to 1 pint (500 c.c.) of lime water.
  - Severe itching, 1 per cent. or 2 per cent. phenol in olive oil; ½ per cent. dilution of liquor cresolis compositus (Sturtevant).
- Desquamation.
  - Cocoa butter.
  - Vaseline (petrolatum) may add.
  - Phenol 1 per cent. or 2 per cent. if itching is severe.
  - Soaking hands and feet in warm water.
  - Do not pick, rub or scrape skin; may cause infection.
- Apply to soles of feet over night 6 per cent. salicylic acid ointment (Sturtevant).
- Itching of scalp.
  - Wash with alcohol, rub in white vaseline (Sturtevant).

Care of mouth.

- Cleansing solutions.
- Physiological salt solution (ʒi–Oi) (4 Gm–500 c.c.).
- Boric acid solution 2 per cent. to 4 per cent.
- Dobell's solution (Sod. bicarb. and borax āā ʒii–Oi (8 c.c.–500 c.c.) with about ⅓ per cent. phenol) quarter to half strength.
- Rinse the mouth with one of the solutions after each feeding.
- Dead spaces between cheeks and teeth searched.
- Teeth cleansed; interstices freed from food; use cotton swab on wooden tooth picks, soaked with a cleansing solution.
- Coated tongue and sordes on lips and teeth, one-half strength peroxide of hydrogen (official) to soften, then cleansing solution.
- Scrape tongue with edge of whalebone after coat is softened.
- Very dry mouth.
  - Two per cent. boric acid solution and albolene equal parts; add lemon juice to flavor.

Fetid breath, foul mouth, stomatitis.
Apply following solution.
℞
Phenol (water solution 1–20).
Glycerin ....aa ʒi (4 c.c.)
Boric acid (saturated watery solution) ℥viii (240 c.c.)
Follow this with a milder solution as above.

Care of nose.

Dried secretions softened with olive oil or vaseline.
Follow with cleansing solutions on cotton swabs or as a spray.
Do not use irrigations.

Care of throat.

Spray with cleansing solutions.
Irrigate with hot physiological salt solutions (110° F.) or 4 per cent. sod. bicarb. solution. Bag a foot above the bed.
Gargles of little use.
For Angina see below.

Care of eyes.

Cleansed with boric acid solution, 2 per cent. to 4 per cent.

Conjunctivitis.

Cleanse with boric acid solution; drop a drop of epinephrin (adrenalin) chloride in eye and follow with 5 per cent. to 10 per cent. argyrol.

Care of genitals.

Nurse or physician should inspect them each day.
Use boric acid solution, 2 to 4 per cent.

Care of bowels.

When first seen.
Calomel. gr. ¼ (0.015 Gm) every quarter hour for five or six doses (well borne by children).
Follow with salts in three to four hours; in adults Epsom, Rochelle or Glauber's ℥ss–i (15–30 Gm) in one quarter glass of water.
In children follow in two hours with
Milk of magnesia ℥ss (15 c.c.).
Liquor magnesii citratis ℥vi–viii (180–240 c.c.).
Rochelle salts ʒii (8 Gm) in one-half glass of water.
Later keep open with enemata or mild cathartic, Liq. magnesii citratis, Hunyadi water or cascara.

For Nausea.

The calomel in divided doses as above.

Sodium bicarbonate .. gr. xv (1 Gm) in ℥ii (60 c.c.) water
Bismuth subnitrate .. gr. xv (1 Gm)
Cerium oxalate ...... gr. v (0.30 Gm) or in combination e.g.

℞

Bismuth subnitratis	gr. xv	1.
Sodii bicarbonatis	gr. x	0.60
Cerii oxalatis	gr. v	0.30

M. Give one such, stirred in a little water, every two hours.

Large dose of Bismuth.

Subnitrate of bismuth ʒi (4 Gm) when severe.

Six drops of 1 per cent. cocaine in a wine-glass of water every fifteen minutes for four doses (Sturtevant).

Treatment of Fever.

Is largely treatment of toxemia.

Treatment of pyrexia *per se.*

When temperature is excessive, hyperpyrexia.

When long sustained above 104° F.

Cold.

Infants, sponge baths.

Children, cold packs and sponge baths.

Early or middle adult life, the bath or cold pack.

With children begin with relatively warm water 95° F. to 90° F. and increase the cold to 80° F. to 75° F. to 70° F. or colder.

Discontinue the bath or pack when patient's temperature is 102° F.

If patient shows evidence of collapse stop the bath, wrap patient in dry blanket; apply heat to extremities. Give hot drinks.

Treatment of Angina.

When membrane is present always take culture for diphtheria bacillus.

If culture can not be taken, give 10,000 units of diphtheria antitoxin.

If case is very severe and no culture can be taken treat as a case of diphtheria. If laryngeal symptoms are present it is pretty surely diphtheria. Take culture, but do not wait for return but give diphtheria antitoxin 10,000 units and repeat in eight or six or four hours, according to severity. Keep the throat clean but use the mildest solutions. Do not use astringents.

Avoid injury to throat by solutions or procedure.

Solutions.

Saline ʒi–Oi (4 Gm–500 c.c.).

Two per cent. to 4 per cent. boric acid solution; half to quarter strength Dobell's solution.

Mode of application.

Irrigations, gargles, sprays, topical application with swabs.

Inhalation.

Irrigation with hot salt solution the best.

Boric acid and Dobell's solution can be used in the same way.

If there is much tenacious mucus give
  Preliminary irrigation or spray with
    Sodium bicarbonate solution, gr. xx (1.30 Gm) to ℥i (30 c.c.)

or

Sodii bicarbonatis.
Sodii biboratis ....āā gr. xxxii (2.00)
Aq. destillat. ....q.s. ad. ℥iv (120.00)
M.

If there is much membrane apply gently peroxide of hydrogen with a swab or an applicator.
Use full strength (official) or spray with same diluted one, two or three times.
Then follow with alkaline irrigation as above to clear mucus.
Then follow with hot saline solution as above.
To afford comfort. Apply between the irrigations sprays of any of the cleansing solutions named.
Inhalations of hot steam, medicated with compound tincture of benzoin or oil of eucalyptus or oil of pine ʒi (4 c.c.) of any of these on hot water or on sponge of croup kettle ʒi–Oi (4 c.c.–500 c.c.); amount of water indifferent.
Use croup kettle.
Simple inhalers.
Common kettle with cone of paper attached to spout.
Pitcher of hot water with cone of paper over opening.
Gargles far less efficacious than other methods.
Use same cleansing solutions named.
Cracked ice.
  Cold applied to neck as compresses.
  Coils.
  Ice-bags (throat-bags).
Heat applied to neck.
Fomentations. (See Chap. IV or V.) (Modify to suit site of application.)
Gangrenous cases.
  Irrigate with potassium permanganate solution 1–2,000.
(Other suggestions in gangrenous cases have been,
  Sprays of adrenalin.
  Gargles of alcohol diluted six to eight times.
  Touching with Tr. Iodine.
Application of Löffler's solution once or twice a day.)

Rhinitis.

Cleansing solutions same as throat.
Sprays best, or swab.
Do not use irrigations unless specially indicated.
If membrane is present.
  Spray with peroxide of hydrogen diluted three or four times.
  Then use cleansing spray.
When nares are blocked or purulent discharge is profuse, irrigate. (For procedure see text.)

- Late Rhinitis, muco-purulent, sero-purulent or severe,
- Is infectious.
- Same measures of cleanliness.
- Staphylococcus aureus usually present.
- Vaccines.
  - 50,000,000 first dose.
  - 100,000,000
  - 200,000,000
  - 300,000,000
- Twice a week.
- Usually three or four doses enough.
- If temperature continues think of sinuses.

Circulatory failure.

- Usually vaso-motor.
- Vaso-motor stimulants.
- Caffeine.
  - Soluble double salt of sodium salicylate or sodium benzoate and caffeine.
  - Adult dose, gr. v (0.30 Gm) into muscle.
  - Child of five years, gr. ss–i (0.030–0.060 Gm).
  - Child of eleven years, gr. i–ii (0.060–0.13 Gm).
  - Frequency every four, three or two hours.
- Camphor.
  - In solution in olive oil or sesame oil 10 per cent. or 20 per cent.
  - Adult dose, gr. iii–v (0.20–0.30 Gm).
  - Child of five years, gr. ss–i (0.030–0.060 Gm).
  - Child of eleven years, gr. i–ii (0.060–0.130 Gm).
  - Give hypodermically or intramuscularly.
  - Frequency every four, three or two hours.
- Caffeine and camphor alternately.
- Strychnine sulphate or nitrate.
  - Adult dose, gr. $\frac{1}{60}$–$\frac{1}{30}$ (0.001–0.002 Gm).
  - Child five years, gr. $\frac{1}{200}$–$\frac{1}{150}$ (0.0003–0.00045 Gm).
  - Child eleven years, gr. $\frac{1}{100}$–$\frac{1}{80}$ (0.0006–0.0008 Gm).
- Adrenalin.
  - In collapse.
  - Give intramuscularly.
  - Dose m. x (0.60 c.c.).
  - or
  - Intravenously m. ii–iii (0.150–0.20 Gm).
  - At ten years, a half dose.
  - At five years, a quarter dose.
  - If above measures are not effectual,
- Digitalis.
  - If the need is immediate and urgent give
  - Strophanthin (Boehringer preferred), gr. $\frac{1}{120}$–$\frac{1}{60}$ (0.0005–0.001 Gm) into muscle.
  - This dose should not be repeated more than once, at an interval of twelve hours.

Follow the first dose by digitalis, either the infusion, the tincture or the leaf.

Give three or four times a day.

Dose.

Infusion	℥ss	(15 c.c.)
Tincture	m. xxx	(2 c.c.)
Leaf	gr. iii	(0.20 Gm)

This is a daily dose of 9–12 grains (0.60–0.80 Gm).

Keep this up for twelve to fifteen doses (three to four days) or until desired results are obtained or some evidences of toxicity obtain.

Child of five years, a quarter dose.

If not urgent omit strophanthin. Begin with digitalis.

I am becoming more and more convinced of the value of digitalis in circulatory failure of acute infections and am giving it preference to the vaso-motor stimulants mentioned.

(See Pneumonia, Chap. IV.)

Nervous symptoms.

Stupor and delirium.

Cold air.
Cold water.
Sponges.
Packs.
Baths.
Ice-bag or coil to head.

Restlessness.

Bromides of potash, sodium, or ammonium or a mixture of equal parts of each.

Dose, gr. xv–xx (1–1.30 Gm) three or four times a day for adult; gr. iii–v (0.20–0.30 Gm) three or four times a day for children.

Phenacetin, gr. i–ii (0.060–0.150 Gm) at four hour intervals may be given to children.

Sleeplessness.

Cold baths.
Cold sponges.
Warm sponges.
Bromides. (See restlessness.)
Phenacetin. (See restlessness.)

Trional, gr. x–xv (0.60–1 Gm) in capsules or in a little warm water or wine, whisky or brandy.

Repeat in two hours if needed (adult).

Chloralamid, gr. xx–gr. xxx (1.30–2 Gm) in powder, **cold** water or wine, whisky or brandy, and repeat in two hours if needed (adult).

Wild delirium.

Morphine, gr. $\frac{1}{8}$ (0.008 Gm) hypodermically for adult; gr. $\frac{1}{48}$–$\frac{1}{24}$ (0.0015–0.003 Gm) for child.

- Specific Treatment.
- Vaccines.
  - Indication in some of the subacute and chronic streptococcus complications of the disease. (See below.)
  - Polyvalent sera.
  - Moser serum.
  - New York Board of Health serum. (See text.)

Otitis.

- Examine ears daily.
- With involvement of drum. (See text.)
- Incise.
- For technique and after care, see text.
- Earache.
  - Dry heat, to avoid maceration of drum.
  - Hot salt bag.
  - Hot water bag. } Applied to the ear.
  - Hot plate.
  - Take a wine-glass made hot by dipping into hot water, put in a pledget of cotton; in this 10–20 drops of chloroform.
  - Apply inverted glass over ear. (Yeo.)
  - Drop into ear two or three drops of 5 per cent. phenol in glycerine.
  - If irrigations are used, use hot water first and drop in 4 per cent. cocaine solution after.
- Mastoid. (See text for symtoms.)
- Surgical procedure.
  - Remember that the discharges from the ear are highly infectious.
  - Destroy by burning or 1–20 carbolic or 1–1,000 bichloride of mercury.
  - Sinus involvement.
  - Cerebral abscess. } Surgical procedure.
- Vaccine treatment of discharge from ear.
  - Determine organism by culture.
  - It may be staphylococcus aureus.
    - Staphylococcus albus.
    - Bacillus pseudo-diphtheriæ.
    - Bacillus pyocyaneus.
    - Streptococcus pyogenes.
  - Vaccine should be autogenous when possible and should be fresh.
  - Time to begin 8th to 16th day of discharge.
  - Contraindications.
    - High fever.
    - Nephritis.
    - Toxemia.
    - Intercurrent affections.
  - Dose beginning.
    - Streptococcus 5,000,000.
    - Staphylococcus 20,000,000.
  - Increase depends on reaction; no reaction, double each dose for

three or four doses; then add 20,000,000–30,000,000 streptococci at a dose; 50,000,000–100,000,000 staphylococci at a dose.
Frequency, twice a week or every five or six days.
Duration, six to twelve doses.
Reaction. (See text.)

Adenitis.

The severe suppurating forms are later manifestations, third or fourth week or later.
Cold.
Ice bags or bladders.
Ichthyol, 25 per cent. in vaseline to pure product painted on.
Heat.
Fomentations. } (See text as to value.)
Poultices. }
Wet dressings.
Huge, very wet dressings at the temperature of melting ice.
Use following solution for dressings.

Plumbi acetatis	60	℥ii
Aluminis pulveris	60	℥ii
Alcoholis	250	℥viii
Glycerini	120	℥iv
Aquæ	1,000	Oii

M. et. Shake.
(Sturtevant.)

At the first sign of suppuration incise.

Arthritis.

Usually in second week.
Treat as in rheumatism. (See Chap. III.)
Suppuration is rare.
Treat on surgical principles. (See text.)

Myositis.

Local treatment and medication as in arthritis.

Nephritis.

Examine urine daily. Keep reagents for albumin test at the patient's.
Severe attacks occur late in third or early in fourth week.
Prophylactic.
Good nursing.
Bed during convalescence.
Avoidance of draughts.
Diet largely of milk.
Treatment.

1. Rest to the functions of the kidney.
2. Treat symptoms.
3. Support patient.

Patient is put between blankets.
Flannel night-gown.

- Diet.
  - If explosive with nausea and vomiting give only cracked ice until these symptoms subside.

Suppression or oliguria.

- No more water than the kidney eliminates.
- Food, only sugar added to water or fruit juices.
- Increase water intake as urine output increases.
- Then begin to add milk tentatively, observing effect on total output of urine and albumin.

Œdema.

- Make all articles salt-free; salt-free bread, salt-free butter. With increasing œdema cut down water intake.

Diet outlined for Scarlet Fever.

- Milk and cereals, bread and butter, is suitable for the nephritis.
- Drinks.
  - Plain water, mineral waters (no NaCl) lemonade, orangeade, Imperial drink.
  - Amount not more than 1 pint to 1½ pints more than urine output.
- Purgation.
  - Fairly copius watery movements by salts.
  - Rochelle, Epsom or Glauber's salts or sodium phosphate.
  - Dose, ℥ss–i (15–30 Gm) in three-quarter glass of water for adults, half this dose for children,
  - or
  - Compound Jalap powder, ʒi in warm water (adult dose).
  - Purgation must not induce fatigue.

Diaphoresis.

- Hot pack once or twice a day.
- Hot air bath.
- Hot bath.
  - Begin at 95° F. for ten or fifteen minutes. Then wrap in a dry or hot moist blanket or pack for another half-hour.
- Drugs.
  - Pilocarpine, only when pack is not attainable, has its dangers. (See text.)
- Cupping.
  - Especially indicated in early stages of congestion and acute suppression; two or more cups over either kidney for fifteen to twenty minutes or until capillaries are well dilated. (For technique see Chap. IV.)
- Counter-irritation.
  - Hot poultices. (For technique see Chap. IV.)
  - Fomentations. (For technique see Chap. IV.)
  - Mustard paste. (For technique see Chap. IV.)

Diuresis.

- After acutest stages have passed.

- Mildest first.
    - Water and drinks mentioned, milk.
    - Then alkaline salts.
    - Potassium citrate.
    - Potassium acetate.
    - Potassium bicarbonate.
    - Sodium bicarbonate.
    - Any one or combination.
    - Dose, gr. xx–xxx (1.30–2 Gm) every two to three hours.
    - Children half dose.
    - Continue until urine reacts alkaline; then reduce dose in frequency, but keep urine just alkaline.
- Little later.
    - Diuretin, gr. v–x (0.30–0.60 Gm) three times a day.
    - (The smaller dose in children or even half this.)
- Agurin.
    - Same dose and frequency as diuretin.
- Theocin. Same frequency as diuretin. Dose gr. v (0.35 Gm) adult.
- Caffeine; especially if the heart is weak.
    - Use double salt of sodium salicylate or sodium benzoate or citrated caffeine.
    - Dose, iii–v (0.20–0.30 Gm).
    - Frequency, three times a day.
    - Child of five years, dose, gr. i–gr. ii (0.060–0.120 Gm) three or four times a day.

Œdema.

- Diaphoresis.
- Diuresis. (See above.)
- Purgation.
- Hydrothorax, paracentesis.
- Acites, paracentesis.
- Anascara–scarification.

Uræmia.

- Purgation.
- Diaphoresis. (See above.)

Hypertension and twitching foretelling convulsions.

- Venesection.
    - Adult, 10 to 20 ounces.
    - Child (five years), 3 to 6 ounces.
- Sedatives.
    - Chloral by rectum.
    - Dose, gr. xxx–ʒi (2–4 Gm).
    - Child (five years), gr. v–gr. x (0.30–0.60 Gm).
    - Give in 2 ounces of warm milk or starch paste.
    - Repeat in two hours if needed.

Convulsions.

- During the convulsion.

Chloroform inhalation until the attack ceases.
Follow at once by
Morphine, gr. $\frac{1}{4}$ (0.015 Gm).
Repeat in half hour if needed.
Child (even infant), gr. $\frac{1}{48}$–gr. $\frac{1}{24}$ (0.0015–0.0030 Gm).
Repeat in an hour if needed.

Enteroclysis.

Salt solution, ʒi–Oi (4 Gm–500 c.c.) 2 quarts (2 litres) at 104° F.–108° F. several times a day.

Lumbar puncture.

(Technique, see Cerebro-spinal Meningitis, Chap. XVII.)

Hypertension.

Nitroglycerine, gr. $\frac{1}{100}$–gr. $\frac{1}{50}$ (0.0006–0.0015 Gm) every two hours.
Child of five years, gr. $\frac{1}{200}$ (0.0003 Gm).

Headache.

Ice bag to head and nape of neck.
Phenacetin cautiously, gr. v (0.30 Gm) every hour for three or four doses.
Child, gr. i–iss (0.060–0.10 Gm).
When excruciating, lumbar puncture.

Nausea and vomiting.

Cracked ice.
Mustard paste to epigastrium 1–4, 5, or 6 of flour.
For technique see Chap. IV.
Bismuth, gr. x–xv–lx (0.60–1–4 Gm).
Sodii bicarbonatis, gr. v–lx (0.30–4 Gm).
Oxalate of cerium, gr. iii–v (0.20–0.30 Gm).
or combined as

Bismuth subnitratis	15	℥ss
Sodii bicarbonatis	10	ʒiiss
Cerii oxalatis	5	gr.lxxv

M. et Div. in chart no. xv.
One in a little water or milk every two hours.

Pneumonia.	Rare complications.
Pleurisy.	
Endocarditis.	
Pericarditis.	

Treat as primary.

Anæmia.

In convalescence give iron,
Blaud's pill (pil. ferri carbonatis),
or
Vallet's mass (massæ ferri carbonatis),
gr. iii–v (0.20–0.30 Gm) three times a day. (Adult dose.)
Basham's mixture (Liq. ferri et ammonii acetatis, ʒi–iv (4–15 c.c.).

Convalescence from Nephritis.

Remain in bed until albuminuria ceases, or for four to five weeks.
After that allow up tentatively, then about house, then out of doors.
Watch effects on albumin, casts, and total quantity.
If aggravated put back to bed.
Wear woolen underclothing.
Adapt clothing to weather.
Avoid exposure to weather.
Change wet clothing at once.
Watch kidneys on occasion of any illness.
Examine urine every three to six months.
Other complications.
Endocarditis. } Rare.
Pericarditis. }
Treat as under other circumstances.
(See Rheumatic Fever, Chap. III.)

Bronchopneumonia.

Treatment. (See Pneumonia, Chap. IV.)

Pleurisy.

Treatment. (See Pneumonia, Chap. IV.)

Noma.

Application of bismuth and water to form thick paste; apply several times a day.
Curetting.
Fuming nitric acid application, excision.

Relapses.

Treat like initial attack.

Discharge of Patient.

Four weeks in the mildest case.
Six weeks is safer.
If still desquamating at the end of six weeks, isolation must continue until desquamation ceases.
If nose, ears or glands are discharging when desquamation ceases isolation must still continue until the discharges cease.
When patient is released from quarantine, he must not mingle with other children for a month after.
Should not sleep with other children for three months (Holt).
Preparation of the child for release.
Soap and water bath, then carbolic acid (phenol) solution (1–50) bath.
or
Bichloride of mercury bath (1–5,000).
Head shampooed.
Northrop's rules.

1. Ears irrigated with bichloride 1–8,000.
2. Scalp shampooed with soap and water.
3. Scalp shampooed with bichloride 1–2,000.

4. Tub bath of soap and water.
5. Tub bath of bichloride 1–8,000 for twenty minutes.
6. Sponge bath of bichloride 1–2,000.
7. Bichloride sponged off with sterile water.
8. Nasal spray of bichloride 1–8,000.
9. Mouth cleansed with saturated solution of boric acid.
10. Taken to a clean room and clad in clean clothes.

Fumigation and Sterilization.

Washable clothing boiled one hour.

Mattresses, pillow, heavy blankets, etc., sterilized by steam under pressure.

Toys. Always destroy; never attempt to sterilize.

Metal objects. Sterilize in 1–20 phenol.

Room. Smooth walls, woodwork and floors washed with 1–2000 bichloride, then

Fumigated with formaldehyde or sulphur.

Formaldehyde best.

- Obtain skilled assistance when possible; otherwise seal room, windows and doors with strips of paper glued together by mucilage of tragacanth over cracks.
- Burn formaldehyde candles or use other generator.
- Must be burned in presence of moisture (water over alcohol lamp).
- Sulphur less reliable and more injurious to fabrics.

After fumigation.

- Repaper, repaint and rekalsomine.

CHAPTER X

DIPHTHERIA

Since the genius of Jenner made the treatment of Small-pox a rare experience for the general practitioner, no other triumph of medicine is comparable to serum-therapy in Diphtheria. Where four children died before the introduction of diphtheria anti-toxin, but one dies to-day and the statistics that show a fall in mortality from 40 per cent. in pre-antitoxin days to 10 per cent. at the present do but scant justice to the efficacy of this treatment, because so much depends on the promptness and mode of administration of anti-toxin, that the figures are vitiated by the neglected cases.

While the organism responsible for the disease may be found in a certain per cent. of cases distributed to various organs of the body, the disease can scarcely be called a septicæmia, but essentially a toxæmia, the toxins in which are elaborated at the site of the membrane formation in the upper air-passages.

Success in treatment depends essentially on an early appreciation of the condition and an early appreciation can be had only by a fidelity to thoroughness in routine procedure. The **early symptoms** are not distinctive; a malaise, a headache, a chilliness and a sore throat; but the sore throat is often trivial or indeed does not occur and in infants there is little to suggest that the throat is the seat of the trouble.

Malaise, a little temperature and a depression and apathy out of proportion to the temperature may be all the child offers to one's observation. The finding of the local lesion comes, then, often enough as a surprise, awarding the routine of examination of the throat.

There are two examinations too often overlooked or slurred that should be made in every instance of infection in infancy, unless the lesion is more than obvious and even then, in search of complications; namely, the ear and the throat. Humiliation comes to almost every man who wilfully or inadvertently overlooks these procedures.

In the case of the ear not a little skill is needed to see at all or intelligently with the older otoscopes, but with the more modern magnifying otoscopes, changes in the ear can be scarcely overlooked. The examination of the throat is more commonly made, but is often a meaningless convention, carelessly done. In the infant a little skill in placing the depressor well back on the tongue gives a momentary, but excellent view; but often this is insufficient and a conscientious examination is put off rather than persist with the crying and struggling child. The tonsils, the pillars of the fauces and the pharynx must be seen.

Such a routine does not allow the condition to be overlooked.

But there is one other fact on which much emphasis must be laid, namely, that diphtheria may be present when the clinician is quite sure that he is dealing with a follicular tonsilitis and, more, diphtheria may be present when no exudate, membranous or follicular is evident and hence, in any inflammation of the throat in a child, even when only catarrhal, **a culture should be made.** Again and especially in infants, nasal diphtheria may be present when no membrane is anywhere visible and a persistent nasal discharge, particularly if excoriating or bloody should demand a culture. Finally, a laryngitis, more particularly of a croupy character and certainly if persisting in the day-time should make a culture imperative.

The Culture. A tube of fresh culture medium must be obtained; the suspected parts thoroughly rubbed with the swab, the surface of the medium thoroughly smeared with the contaminated swab; great care must be taken to bring the swab into contact with no other object in the procedure; the culture submitted to a competent bacteriologist for incubation and diagnosis.

The Family. When diphtheria is determined in any one individual, all the members of his family at once become suspects. The children are to be kept from school and adults who have intimate relations with children, such as teachers, should temporarily interrupt their occupation.

Authorities should be informed of the case and inspection of the school or suspected groups of people, who may be the source of infection, should be made.

Children should be isolated until cultures can be taken from their throats and a report made on the cultures. **Adults** in the family should submit to the same procedure. In this way those who are either suffering from a catarrhal diphtheria or are in the incipiency of an attack or are "carriers" can be determined and can be kept in isolation until their throats are free from infection.

All the children in the family, whether the cultures are negative or positive, or better, without waiting for the return from the culture, should be immunized with antitoxin, 500 units for the infants and 1,000 units for the older children and adults. All adults in intimate contact with the case should be immunized and it were better for all adults remaining in the house, no matter how careful the quarantine, to be immunized.

Children, free from infection as proved by negative culture, should be removed from the house, if possible. If this is not possible, the immunization should be repeated every three weeks. Children found to be infected or to be carriers should be isolated, but never with the sick case, and the isolation of these cases should be separate.

If the case can not be isolated in the home it should be removed to a hospital, if one is accessible. Treated at home one chooses a

Room. The choice, preparation and maintenance of the room in a case of diphtheria is the same as in a case of scarlet fever. (See Scarlet Fever, Chap. IX.)

Nurse. Identical instructions should be given and precautions taken as in a case of scarlet fever. (See Scarlet Fever, Chap. IX.)

It is to be remembered, however, that the great danger comes from the secretions of the throat and nose and every precaution must be taken in the treatment of the throat or nose to avoid receiving a cough or sneeze direct in the face. All the secretions should be received on cloths that may be burned.

The nurse may use mild sprays and gargles as a precautionary measure, but no astringents. It is to be remembered that the healthy mucous membrane is resistant to invasion by the bacillus, but when abraded, irritated or inflamed becomes the site of infection.

A wise measure on the part of the nurse is to accept an immunizing dose of antitoxin, 1,000 units, repeated at an interval of three weeks.

The bacillus is not air borne and the antiseptic bath and shampoo when the nurse is likely to meet others outside the house is not so imperative as in the case of scarlet fever, but she should not see children on these occasions nor come into so close contact with others that she might convey bacilli from her own throat, by coughing, sneezing, close conversation or kissing.

Physician. Such precautions as the physician takes in visiting a scarlet fever case he takes in treating diphtheria. (See Scarlet Fever, Chap. IX.)

He, too, remembers that his danger lies in examining the throat and in the cough he provokes. He may use mild gargles or sprays, one-half strength Dobell's solution or saturated solution of boric acid; but if the patient has coughed in his face he should certainly have recourse to an immunizing dose of antitoxin, 1,000 units, if he has not already done so as a matter of precaution.

With the knowledge of the organism, its origin and mode of transmission, he finds the antiseptic bath after the case less compelling than in scarlet fever, but is doubly cautious about his mouth and throat and the danger of conveying infection from them, as he may well do in his own family.

Precautions in the Sick Room and the **temperature of the room** are the same as those observed in scarlet fever. (See Scarlet Fever, Chap. IX.)

Bed. (See Chap. IV.)

Patient. The patient must be made to go to bed, no matter how light the attack may appear to be, explanations being made to him or to the parents of the insidious effects of the disease on the cardiovascular apparatus and the kidney and the meaning of rest, such only as the bed can afford, to these structures.

Bath. A warm sponge bath of soap and water is given each day for cleansing purposes.

Nightgown. Such an one as can be easily opened for examination of the heart and lungs without effort to the patient.

To the parents or friends the physician must talk frankly of the dangers that any physical effort on the part of the patient entails in terms of cardiac failure. They must understand that this danger is greatest as convalescence approaches. It is the only way in which the insistency of the patient and especially the little patient can be met.

The rest, even in the mild cases, must be absolute; the patient remaining in recumbency, not allowed to turn himself without help, if the case has in any measure been severe and, indeed, in all cases the bed-pan must be insisted on.

During the height of the illness only one low pillow should be allowed and another not until the end of two weeks and not even then if he has been very ill or there are any indications of nerve involvements.

Diet. There are certain fundamental principles that determine the dietary in all acute febrile diseases. An occasional review of these principles is extremely helpful in doing justice to a field of therapy grossly neglected. (See Diet in Acute Febrile Diseases, Chap. II.)

Tissue destruction in acute infections is due to three causes: (1) pyrexia; (2) toxæmia; (3) starvation. In diphtheria the first factor is feebly operative, for as a rule there is little fever and in many of the worst cases none at all; but the second factor, the operation of toxins is perhaps more potent than in any of the common infections, while the third factor is enhanced by the difficulty of swallowing in angina.

Moreover, it has been shown that tissue destruction continues well beyond the febrile period, as if a late autolysis had occurred in tissue attacked by the toxin earlier in the infection. This tissue destruction both early and late has been lessened or stayed by a sufficiency of diet and considering the important organs attacked by the toxins, heart, kidney, nerve tissue, enough food to meet the daily metabolic demands and furnish material for repair is in this disease especially urgent.

The details of such a dietary are to be found under Diet in scarlet fever (see Scarlet Fever, Chap. IX), and needs no modification for diphtheria.

In diphtheria, however, both the angina and pharyngeal paralysis may make the feeding exceedingly difficult. If from pain, regurgitation through the nose and disinclination, the diminution of food intake threatens the strength, the food must be administered by gavage or by rectum. The stomach tube is the best means to effect this end. In the adult one may feed by the tube, milk 500 c.c., sugar 50 grams, and one egg three times a day, or one may fortify this food by adding milk sugar 1 to 2 ounces and cream 1 to 2 ounces or even more, at each feeding. In this way one may get in well over 2,000 calories.

In young infants the stomach tube is preferable, but over the age of three years more difficult than the use of a nasal tube.

Rectal feeding is not so satisfactory, but when the feeding by the mouth is difficult or impossible may answer in some measure for a brief period.

When swallowing is painful an insufficiency of water is ingested and a pint of water twice a day by the rectum or a Murphy drip may supply the needy tissues.

A nursing infant affected should be taken from the breast but fed the mother's milk obtained by the use of a pump or by expression and if this is insufficient, the milk of a wet nurse can be used to advantage. Mixed feeding may be cautiously undertaken, but it is a bad time to institute artificial feeding of any kind.

Water or diluted fruit juices should be given as freely as the patient wishes and, indeed, should be offered every hour or two, as apathy induces on the part of the patient neglect.

Mouth, Throat and Nose. The toilet of the mouth, throat and nose is important. It is rather prophylactic than curative. When properly carried out, it lessens the probability of mixed infections and extensions.

Whatever is done must be done with care and gentleness; for any trauma suffered by the invaded tissues, enhances the spread and severity of the diphtheritic process and invites the invasion by other organisms.

The purpose is cleanliness and nothing subserves this purpose better than physiological salt solution, as spray, or irrigation. Dobell's solution in one-half or one quarter strength may be used for the same purpose.

After taking food the mouth should be rinsed with one or the other of these solutions and the teeth, the spaces between the teeth and the dead spaces in the mouth, cleansed of particles of food by cotton on a tooth-pick as an applicator soaked in these solutions.

When there is **sordes**, the milder applications may well be preceded by half strength hydrogen peroxide. The softened coat on the tongue may be removed in part by scraping with the edge of a whalebone.

A dry mouth is relieved by equal parts of 2 per cent. boric acid solution and albolene to which a little lemon juice has been added; if there is fetor or a foul stomatitis the following prescription is useful:

℞—Phenol (watery solution 1 in 20)			
Glycerin	āā	℥i	30
Boric acid (saturated watery sol.)		℥ viii	240
M.			

Follow this with the milder applications.

For the **nose** use the same mild solutions with the applicator or spray, but avoid the douche. For dried secretions, use a little sweet oil on an applicator to soften before using the saline or Dobell's.

The **genitals** are freed from secretions by the use of the same solutions.

With angina or nasal involvement the above procedures are modified or supplemented.

Bowels. Putrefactive processes in the large intestine, enhanced by constipation and possibly by other conditions attendant upon infection will only add to the burden the patient has to carry; hence, attention to the bowel early in the illness is of importance.

Calomel and salt may be given to the production of one or two loose movements.

Calomel in gr. ¼ (0.015 Gm) doses every 15 minutes until 1 or 1¼ (0.060–0.075 Gm) grains are taken work well in the child and may be followed in 2 or 3 hours by a half ounce of milk of magnesia.

In young children or adults, salts, Epsom, or Rochelle, in doses of ℥ss to i (15–30 Gm) in a half to three quarter glass of water are efficacious or we may give 1½ to 2 grains (0.10–0.120 Gm) of calomel and follow in about 3 or 4 hours by the above dose of salts.

The bowels should be kept open either by the use of an enema or a mild saline water of the type of Hunyadi or liq. magnesii citratis given every other day.

Serum Treatment. The success of modern medicine is the reward of an effort to discover Nature's method of combating disease. Nowhere has that success been more unqualified than in the field of serum therapy in its application to diphtheria.

The bacillus diphtheriæ is one of the relatively few organisms which secretes its poison to operate at a distance from the site of its growth and multiplication. This deleterious material is called a toxin. Many more pathogenic organisms exert their toxic effect upon the host by a material so closely associated with their substance that its liberation depends on the destruction or damage of their own structure. These toxins are called endo-toxins. We do not know the chemical nature or intimate structure of the toxins, but we know something of their effects and none are more remarkable than their effect to excite in the tissues of the animal invaded the production of substances that neutralize their toxic action, that is, antitoxins.

Invading the tissues of the upper air-passages, the diphtheria bacillus finds a suitable soil for multiplication. Here it secretes its toxin, which operating locally causes inflammation with destruction of tissue, which produces the characteristic membrane and passing into the circulation attacks various tissues, for some of which it has an especial affinity and upon which it exerts its toxic effects peculiarly; such are nervous tissue and those of the heart and kidney.

These toxic molecules are believed to consist of a nucleus with certain chemical groups, assumed to be akin to the side chains of a benzol ring. One of these side chains has an affinity for certain side chains in the molecules composing the tissues concerned and effect through these an attachment of the toxin to the cell. This side chain, seizing the cell, as it does, is called a haptophore group. The toxin, too, has another side chain, which thus brought into intimate contact with the cell exerts an injurious effect upon it. This is the toxophore, or poison bearing group. The damage done the cell by this toxophore group, if it does not kill it, stimulates it to reparative processes. The part repaired is the group damaged, that is, the haptophore group of the cell, seized by the haptophore group of the toxin. This process of repair is, however, in excess of actual need and the superfluity of haptophore groups of the cell are set free from it into the blood-stream and, combining with the toxins not yet attached, divert them from the cells. This substance, that is, these haptophores of the cells, are called antitoxin.

When the antitoxin has been manufactured in sufficient abundance to neutralize successfully the toxin, the animal is said to have acquired an immunity and this process is one of active immunization, active because the tissues have been physiologically active in the production of their own mechanism of defense.

But if the blood of the animal, so cured, or the blood of an animal in whom the same process had been induced by introducing the toxin gradually, that is, giving him the disease by degrees and repeatedly inducing ever increasing degrees of immunity, is drawn off and this antitoxic substance be isolated, it can in turn be injected into another animal and neutralize toxins circulating in his blood or tissue fluids and render him immune; but as this latter animal's tissues have not been actively engaged in the manufacture of this antitoxin injected, he is said to have a passive immunity conferred on him.

Diphtheria antitoxin, then, is manufactured by the horse in the process of acquiring an active immunity to the diphtheria toxins injected into the tissues in increasing doses. This is withdrawn, submitted to certain processes for isolation and preservation and used in the treatment of diphtheria in man, on whom its injection bestows a passive immunity.

Methods of preparation have improved since first this agent was offered to therapy and appreciation of its close relation to certain globulins in the serum has made it possible, by isolating these, to avoid in some measure certain disagreeable results attendant on its usage and has at the same time procured a more concentrated product.

Some measure of its activity had of course to be sought, and the unit that has been established is in terms of its power to neutralize toxic doses in definite animals of definite weights.

The unit agreed upon is the amount of antitoxin which will just neutralize 100 minimal fatal doses of toxin for a 250-gram guinea-pig.

Antitoxin coming from reliable sources is fairly stable, if properly preserved. According to Park if kept cold and not exposed to light and air, it will not deteriorate more than 30 per cent. in a year. It loses some 10 per cent. in two months. Allowance may be made for this in dosage.

Dose. We cannot estimate the amount of toxin in a given case and so can not use it as a measure of the quantity of antitoxin to be used. Our dose is established empirically largely.

The dose is not determined by age, except in very young children, under two years, when it is slightly less.

Park and Biggs think weight should have some consideration.

No amount is known to be injurious in any measure. The limit of the dose is set by the needs of the case and by expense.

The dose is modified by two considerations:

1. The severity of the disease.
2. The day of the disease when first seen.

The tendency in this country is to be liberal in the dosage. It is a good rule when in doubt whether to give a larger or smaller dose to choose the larger.

When Seen Early. In mild cases, that is, in cases of simple congestion from which the bacillus has been recovered, or in those with a small patch confined to one tonsil, give 3,000 to 5,000 units.

This should be repeated in twelve hours if there is no sign of improvement. If better, one may wait for twelve hours longer, repeating the dose if improvement does not continue.

A More Severe Case, such as involves both tonsils, requires a larger dose 5,000 to 6,000 units and should be seen again in six hours. If spreading, repeat; if not wait another six hours. If no signs of improving, give the second dose and repeat at six or twelve hour intervals until the improvement is satisfactory.

If the process has spread from the tonsils onto the pillars or pharynx give 8,000 units and repeat at six to twelve hour intervals as above.

If a **pharyngeal** case shows (1) decided toxic symptoms or (2), if there are any **laryngeal** manifestations, such as hoarse cry, stridor or laryngeal cough or (3), if in addition to pharyngeal involvement there is **nasal involvement** give 10,000 units.

In these cases and especially in the laryngeal, the case should be continuously watched, both to be prompt in repeating the dose and to intervene with the intubating tube, if needed.

The dose should be repeated every six hours until there is improvement and if the spread is increasing one may repeat in four hours.

In **malignant cases,** cases in which the spread is very rapid and the symptoms toxic 15,000 to 20,000 units should be given.

If the dose can be given intravenously the result will be best. If the vein can not be entered, as is the case often in small children, go into the muscles of the buttock, as the wide net-work of veins in the muscle facilitates absorption.

These doses are repeated at four, six or twelve hour intervals and are sometimes carried to total amounts of 60,000 to 100,000 units. Apparently hopeless cases sometimes rally under this large dosage. Both McCollom of Boston and Weaver of Chicago are advocates of these large doses.

In severe or laryngeal cases under two years the dose is 5,000 to 6,000 units, repeated at six, eight or twelve hour intervals.

Cases Seen Late. Every day of delay increases the dangers, both in terms of death and complications, heart, kidney or nerve involvements.

When antitoxin is administered on the first day the results are most brilliant, the mortality amounting to only a little over 1 per cent. and in some considerable series with no mortality.

But on the second day the dangers have increased and the statistics show about 4 per cent. to 5 per cent. and in some series a still higher.

The mortality of cases treated on the third day has doubled and tripled over the second, running from 9 per cent. to 13 per cent. and on the next day still higher, 15 per cent., 17 per cent., even 24 per cent. in some series.

This means larger doses with each day. Holt has said if the case has been three days ill he should have three times the ordinary dose.

The tendency, I think, is toward liberal dosage. Park has pointed out that the "larger the amount injected into the tissues the quicker will a considerable amount be absorbed into the blood and pass into the body fluids. Only a small percentage of what is in the blood passes out of the vessels into the tissue fluids. It is for this reason that, if we would neutralize toxin that has passed from the blood stream, but has not yet united with the tissue cells, very much more must be given than the amount of antitoxin that would be required in a test-tube to neutralize the toxin."

Moreover it has been shown that the toxin is not a simple body, but that a certain portion, called protoxoid has to be neutralized before the toxin is affected and neutralized and that then there is a portion, called toxon, which is believed to be responsible for the toxic changes in nerve tissue which does not combine with antitoxin until all the toxin molecules are satisfied. It is necessary, then, to give such large doses as may reasonably assure us that this portion, the toxon, shall be neutralized. It must be remembered that the body is at the same time manufacturing its own antitoxin which may have increased the richness of antitoxin content of the blood enormously.

Technique. The operator's hands should be cleansed with soap and water and alcohol or 1 to 1,000 bichloride.

The skin of the patient should be cleansed with soap and water and alcohol, or a good scrubbing with alcohol may answer.

Antitoxin is now put up by a number of reliable firms, sent in containers which are themselves the syringes, with sterile needles accompanying. This needle may be dropped into alcohol before using, as an extra precaution. If such conveniences are not at hand, a glass syringe or one that, like it, may be subjected to boiling should be used.

The needle should be boiled and attached by a short piece of sterile rubber tubing to the syringe. This is intercalated to prevent breaking or bending or wounding other structures if the child struggles.

A syringe from which the plunger may be withdrawn is preferable because the serum may more readily be poured into the barrel of the syringe than drawn up through the needle. When this is done the little air must be expelled through the needle before it is used.

Site. An excellent one is the loose tissue of the back at the angle of the scapula, into the loose tissue of the abdominal wall or into the buttock and if it is desired to give it into the muscle in an urgent case the buttock serves well. I prefer the side of the buttock.

As has been said, in profoundly toxic cases an intravenous injection is to be preferred, if possible.

Evidences of Improvement. First, a pause in the spread of the membrane; then, in twelve hours to twenty-four hours the membrane softens, loosens, recedes, disintegrates. With this the swelling of the mucous membranes diminish and there is an amelioration of the general condition, a betterment of the pulse, and a lowering of the temperature.

In laryngeal cases, the stridor lessens, there is an improvement in the cry or voice and the cough is looser. In nasal cases the breathing is less obstructed and the discharge lessened.

Disagreeable or **dangerous results** of **antitoxin administration.** Skin rashes are by far the most common, but far less frequent with the use of the refined and concentrated serum than with the old.

An erythema may be seen in a few hours, but it soon disappears. After a period of days, seven to fourteen, a rash occurs, either erythematous, that may be mistaken for scarlet fever (the mucous membranes of the mouth and pharynx are not affected, a distinguishing feature from scarlet fever) and which may desquamate; morbiliform, mistaken for measles, or most commonly, urticarial, which may give much annoyance.

This eruption is often accompanied by other manifestations of intoxication; a little temperature, swelling of the glands and at times enough joint pains to suggest rheumatism and perhaps a little albuminuria. The whole process and the period intervening between it and the injection suggest a period of incubation of an infectious disease and is attributed to the effects of certain proteids in the serum and their effects on the tissues to the production of toxic substances. It occurs commonly after the first injection and is not to be confounded with that more sudden and explosive reaction that may follow an injection repeated ten days or longer after the first injection, the result of a sensitization of the tissues by the first serum introduced, constituting the phenomenon known as anaphylaxis.

The most important part of the treatment of this condition is an explanation of its meaning to the parents or patient who may be alarmed by its manifestations.

The pains may be allayed by fomentations applied to the joints or by the use of aspirin. The urticaria is best treated by sponges of water containing sodium bicarbonate or bran.

It lasts but two or three days.

Sudden Deaths. Very rarely sudden deaths or a condition threatening death occurs. It is possible that some of these sudden deaths may be attributed to status lymphaticus; but more commonly they have occurred in people who are asthmatics and of these a considerable number are of that type of asthmatics whose attacks are excited by the presence of horses. These people seem to be sensitized to some proteid of the horse given off in the secretions or discharges of the animal which are carried a considerable distance through the air.

Injection of antitoxin into these people introduces directly the substance to which they are sensitized and an anaphylactic seizure is the result.

I saw one attack in a physician, a victim of horse asthma, precipitated by an immunizing dose of antitoxin given himself. The attack was characteristic of its kind and copied the reaction in the animal exactly. The reaction was immediate, before the needle was withdrawn. He was seized with most urgent dyspnœa, intense cyanosis and prostration. His lungs were filled to the utmost and he was incapable of expelling air from his chest. He was relieved only by having his chest encircled in the arms of his attendant and compressed until air was expelled that might be replaced.

So great was this distension that acute emphysema ensued with rupture of the air into the mediastinum and fascial planes of the neck. Atropine and morphine and adrenalin were liberally administered. Cupping also afforded some relief.

Asthmatics should receive the antitoxin with great precaution.

It is better to inject three or four drops, to which a reaction, distinct, but not fatal, should follow and afford warning. If no such reaction follows one may give the whole dose in twenty minutes. It were well to administer a full dose of atropine gr. 1/100 (0.0006 Gm) with the serum as a further precaution.

Park's advice is even better. He recommends a concentrated antitoxin, calling attention to the fact that antitoxin can now be procured with the value of 3,000 units to 1 c.c.

Give of this 0.2 c.c. If no bad results ensue give in an hour another 0.2 c.c. and in another hour 0.4 c.c. and repeat this amount at hourly intervals until the desired dose is attained.

In all cases excessive precaution would demand the injection of a few drops (Rosenau says one or two and that more is dangerous) wait an hour and if no bad results ensue give the rest.

Immunizing Dose. The immunizing dose touched upon should be 500 units in infants and 1,000 in older children and adults.

The effect lasts but a short time. Park says that at the end of five days 90 per cent. has been eliminated and at the end of two weeks 99 per cent. Hence, in the presence of continued danger a second dose should be given at the end of a week and certainly at the end of two.

Anaphylaxis, as seen in sensitized animals is a rare occurrence in man, but a few drops twenty minutes before as mentioned above would prevent disaster.

Park also advises the use of human serum, which can be obtained containing 50 units to 1 c.c. for immunizing asthmatics.

Schick has devised a method depending on the injection of minute quantities of diphtheria toxin to determine the presence or absence of antitoxin in normal individuals.

When antitoxin is present it neutralizes the toxin and there is no reaction. If antitoxin is absent there is a local reaction resembling a Von Pirquet reaction.

Moreover the amount of antitoxin can be measured.

It is found that 80 per cent. of new borns have immunity; that the figure falls to 40 per cent. at one year and rises to 90 per cent. among adults.

Probably $1/20$ unit of antitoxin per c.c. will afford immunity.

This amount is often found multiplied many fold in normal individuals.

While this method is at present scarcely applicable in private practice, in institutional work it becomes of real economical significance.

Laryngeal Diphtheria. The gravity of this condition and its frequency, for it is said to occur in 40 per cent. of children attacked under three years, make it imperative to appreciate its earliest manifestation.

While it is true that a catarrhal laryngitis may occur in pharyngeal diphtheria, such an assumption should not modify our procedure in the least.

When any laryngeal symptoms occur in the course of a pharyngeal diphtheria, it is to be treated as such and treated promptly. When, however, the laryngeal diphtheria is primary, the differentiation from catarrhal laryngitis and spasmodic croup is not so easy. If the child has been exposed, the assumption should be that the case is diphtheritic and one should not wait upon the return from the culture. When there has been no exposure, however, one has to obtain a culture and study the course of the disease.

A positive culture, of course, settles the matter, but a negative culture does not exclude it, as some 40 per cent. of the cases coming to operation and studied by McCollom were negative.

Spasmodic croup is usually at its worse at night and with the morning finds a decided amelioration or cessation of the spasm, but when the spasm continues in the succeeding day or dyspnœa comes on, that is, the lesion shows progression, the condition should be assumed to be diphtheritic, on the symptoms alone.

The symptoms are in the beginning hoarseness of the voice and cough, which takes on a metallic character. This is in the catarrhal or earliest stage. Soon true croup begins, characterized by spasm of the larynx with stridor and dyspnœa but with remissions. It is due to the same irritative causes as spasmodic croup. This is the second stage. Following this comes the evidences of continuously increasing obstruction with dyspnœa, cyanosis, restlessness, prostration, feeble pulse, a rising temperature and stupor. No such clear cut stages are to be anticipated, however, in each case.

The stridor is of a peculiar, hissing or sawing character which continues throughout inspiration and expiration.

The important symptoms are hoarseness, metallic or croupy cough, restlessness, prostration, increasing dyspnœa taking on a sawing character.

McCollom adds one other symptom upon which he lays great diagnostic stress, namely a rigidity of the sterno-cleido-mastoid muscles, which he says is always present and even early, both in adult and children.

Antitoxin should be given, as noted above, at the earliest moment and in large doses, 10,000 units and repeat in six hour intervals, if there is spread and in six or twelve hour intervals until decided improvement is seen.

Intravenous administration is always to be preferred.

In young children the condition may prove fatal in thirty-six to forty-eight hours. One sees, then, how urgent the early administration is.

Before antitoxin treatment 90 per cent. of these cases came to operation; since the introduction of the serum, 40 per cent.

Other Treatment. Besides antitoxin nothing has more than palliative effect and one should not allow any measure undertaken delay the administration of antitoxin an instant.

Steam. Inhalation of steam seems to relieve the spasm to some extent, though of course not the obstruction.

The best way to administer it is with the croup kettle or two or three croup kettles directing their steam as close to the child's head as is safe. A tent may be made by putting a sheet over the upper third of the bed, so that the body will not be bathed in the steam or one may lash an open umbrella to the head of the bed and pass a sheet over this or put a clothes-horse around the head of the bed and drape a sheet over this. This should not be kept up for long periods, as the heat is depressing.

The steam lessens the spasms and is said to facilitate the discharge of secretions.

Hot fomentations to the throat have been advised and some authors say relief is sometimes afforded by the ice-bag applied to the neck.

INTUBATION

By Miner C. Hill, M. D.

Procedure. 1. Select intubation tube of suitable size for age of child, according to scale, and be sure that braided silk thread is attached.

2. When tube is on the obturator the broad flange of the head should point away from the instrument. The silk thread is then to the operator's right.

3. Assistant wraps child in a mummy sheet and places some padding under the neck or holds the patient's head over edge of table. Mouth gag is inserted in left side of mouth.

4. Operator takes his position on right side of patient, inserts

left index finger along tongue, parallel with median line, until tip of finger locates epiglottis pulling it forward.

5. Handle of intubator is held in right hand close to the patient's chest with one finger through loop of thread and thumb upon the releasing knob.

6. The tube is then advanced along midline of tongue parallel to left index finger until epiglottis is reached.

7. As the tube engages the larynx the handle of intubator is raised and the tube is quickly, but without force, inserted into the larynx. Any undue force is liable to cause a false passage.

8. Tip of left index finger holds tube in place while releasing knob is pushed forward and obturator is withdrawn.

9. When tube is felt securely in place tip of left index finger is again placed upon head of tube while loop of silk is cut and withdrawn.

10. A tracheotomy set should always be in readiness in case intubation is unsuccessful.

A successful intubation is made evident by a characteristic expiratory cough and inspiratory whistling sound and the patient's attitude changes from one of horrible restlessness and fighting for air to one of peaceful quiet and a desire to sleep.

The patient should be watched intently after intubation.

Occasionally the tube is coughed up and with it a membranous cast of the larynx and reintubation may not again be necessary.

If the tube is coughed up and dyspnea returns, intubation must be repeated using the same tube and not one of next larger size, for fear of causing pressure necrosis of the cricoid cartilage.

Indications for Intubation. Laryngeal diphtheria is diagnosed by croupy cough, stridor, interference with voice production, increasing dyspnea and cyanosis. No signs of pharyngeal or nasal involvement need be present. When the dyspnea has so far progressed that there is retraction of the episternal notch and supra clavicular regions and a pulse that disappears with each inspiration, intubation is indicated. If one wait until there is cyanosis the exhaustion will be so great that the chances of successful intubation are greatly diminished.

Post-intubation Treatment. Our first apprehension after intubation is the danger of expulsion of the tube during a fit of coughing and constant watching is necessary. If the cough is troublesome, the croup kettle and the use of antipyrin or small doses of codeine may give relief.

The next difficulty is the feeding of these cases. At first it is often difficult for the patient to swallow, particularly liquids. Milk toast, thick cereals, custards and ice cream are preferable to liquid food. To facilitate swallowing the patient may be fed while reclining with the head lower than the body (Casselberry Method).

When even this method fails, gavage or rectal feeding may be employed.

EXTUBATION

When the temperature subsides, usually about the fourth day, it is safe to see if the child can do without the tube. The sooner the tube can be removed the less danger there is of pressure injury to the larynx.

Procedure. 1. Have near at hand an introducing instrument with a tube of the same size as the one to be removed.

2. Wrap child in a mummy sheet to prevent struggling, and insert mouth gag.

3. Place tip of left index finger upon head of tube and left thumb against cricoid cartilage externally.

4. Introduce extractor, parallel to median line of tongue, guided by left index finger until one is sure that tip is within lumen of tube.

5. Raise handle until it touches the upper incisor teeth, then the jaw of the extractor will pass well within the lumen of the tube. Now press the lever on handle and, reversing the motions used in intubation, remove the tube.

The secret of successful intubation or extubation is in keeping the instruments, throughout the whole manipulation, parallel with the median line of the tongue.

Auto-extubation. May occur early or late in the disease. When it occurs early, on third or fourth day, the patient has usually sufficiently recovered to be able to go without the tube. When it occurs later, from tenth day to third or fourth week, it is usually persistent and tube may be coughed out as many as thirty times in twenty-four hours. This persistent coughing up of the tube is due to a perichondritis at the cricoid level and therefore the tube can no longer be held in place by the retention swell for the firm cartilaginous larynx at the cricoid level is converted into a collapsible tube. This condition occurs in from 3 to 5 per cent. of intubation cases. The treatment of these cases is by a bulbous tracheal tube which is longer than the O'Dwyer tube and reaches well down into the trachea. These tubes will practically put a stop to auto-extubation.

Tracheotomy. For this procedure one should have recourse to surgical text books.

DIFFERENTIAL DIAGNOSIS

Spasmodic Croup. Sudden onset and sudden subsidence. No aphonia. No progressive dyspnea but a succession of attacks during the acute stage with marked improvement during the intervals.

Retropharyngeal Abscess. Absence of aphonia but there is a muffled voice with a throaty stridor. Dyspnea is greater when mouth is open. Head is held thrown back. Digital examination reveals a fluctuating mass on posterior wall of pharynx.

Foreign Bodies. Onset is very sudden, there is a paroxysmal cough and violent dyspnea. If the foreign body is not coughed out but becomes impacted death may rapidly follow from occlusion of the glottis.

Bronchopneumonia. When the pneumonia is bilaterial in children, there may be marked retraction of the chest and sinking in of the epigastrium. There is absence of a croupy cough and the different character of the dyspnea together with the physical signs in the chest clears the diagnosis.

Subglottic Edema. May give rise to the same symptoms as laryngeal diphtheria and an examination of the larynx is necessary to differentiate.

Phlegmon of Glottis. No croupy cough or aphonia. Examination shows marked inflammatory swelling of epiglottis and arytenoid region.

Nervous Diseases. In certain acute infections as poliomyelitis, superior basilar meningitis, encephalitis and cerebellar abscesses there may be laryngeal symptoms due to irritation of the basal ganglia. Dr. H. L. Lynah has reported two interesting cases, one, a case of cerebellar abscess where the respiration simulated that of laryngeal obstruction. Evacuation of the abscess relieved the respiratory condition. Another, diagnosed as laryngeal diphtheria, proved at autopsy to be an encephalitis with an enormous increase of fluid in the ventricular spaces.

Recurrent Laryngeal Nerve Paralysis due to mediastinal tumors simulates laryngeal diphtheria but is differentiated by laryngoscopic examination. In this condition the obstruction is below the larynx and there is no loss of laryngeal function. The expiratory dyspnea is greater than the inspiratory and percussion, X-ray and course will clear the diagnosis.

TREATMENT OF SYMPTOMS

Fever. A high temperature is not characteristic of the disease; on the contrary, the temperature is relatively low. Treatment for it, as such, is not indicated and antipyretics are absolutely contraindicated on account of their depressant effect on the circulation. Sponge baths, luke warm or cool so far as they increase the patient's comfort may be given.

Angina. In many cases there may be very little discomfort in the throat, again the throat and mouth may be extensively involved with much fetor, while with the invasion of other organisms, the inflammatory reaction and discomfort may be much increased.

External Applications. Cold or heat applied to the neck, preferably the former, afford relief. **Cold** may be so applied in the shape of the ice-bag, the coil or compresses.

Heat. If heat is found the more grateful, it may be afforded by the use of hot fomentations.

Applications to the Throat. It must be remembered that no applications that can be made will kill the organisms concerned and the best we can do is to make such applications as preserve the maximum amount of cleanliness of the part and so lessen the likelihood of spreading, of inviting the invasion of other bacteria or of permitting decomposition and putrefaction.

We must remember, however, that these very efforts, unless judiciously carried out may do damage to the invaded tissues and hasten the very processes they were designed to prevent.

Applications are made by the gargle, spray, irrigation or swab. A gargle is painful and does not reach the parts most affected and serves for little better than a mouth wash. The spray is a better method, but by all odds the best is the **irrigation.**

The best irrigating fluids are those blandest to the inflamed mucous membranes, such as sodium chloride in physiological solution (one dram to the pint) or 2 per cent. boric acid solution or Dobell's solution diluted two to four times. It should be as hot as the patient can comfortably stand it, 100° F. in a child, 110° F. to 115° F. in an adult.

A fountain syringe or irrigator is held above the head at a height sufficient to give free movement to the stream, but not force; a nozzle of hard rubber or metal, or in older children a catheter may be used.

The patient, unless the case is of the mildest, should not sit up in bed, lest cardiac failure should occur, but lying on the side at the edge of the bed, with a towel about the neck and a pus-basin or other receptacle under the chin to catch the fluid. In older patients the tongue may be depressed by a wooden or glass depressor or the nozzle may be inserted between the molars and the stream directed in various directions.

One should use from a pint to a quart or more. If the mouth is foul they may be given every two or three hours, in less severe cases three times a day.

If there is a great deal of mucus, the throat may receive a preliminary spraying with a solution of sodium bicarbonate gr. xx to the ounce (1.30 Gm–30 c.c.), the membranes gently touched with half strength peroxide of hydrogen and then the irrigations be given. Sprays of the same substances as the irrigations may be given as often as they afford comfort. No measures that cause pain should be persisted in.

Many authors are impressed with the cleanly appearance afforded by applications of Löffler's solution. (For formula see Scarlet

Fever, Chap. IX.) It should be applied with a swab on an applicator and held pressed against the membrane not swabbed around. This may be made two or three times a day. **Cracked ice** held in the mouth gives much relief at times.

The **pain** of **swallowing** when great may be alleviated by the application of 1 per cent. to 2 per cent. cocaine.

In very foul mouths 1 to 2,000 permanganate of potash may be used as an irrigation before using the saline.

Nose. Most authorities are in agreement that in nasal diphtheria, irrigations are indicated. McCollom, however, deprecates the procedure, because he is convinced that the number of middle ear cases increase under it.

It would seem, however, that in the great danger attending these cases, with involvement of the rapidly absorbing naso-pharynx that some means of cleansing the area involved were necessary and that irrigation was the only efficacious means.

The same solutions may be used as in the throat, namely, warm physiological salt solution, 2 per cent. boric acid solution or Dobell's diluted one to four times.

A fountain syringe, held at such a height as to just force the solution through in a gentle stream and a glass nozzle or a small rubber catheter, with holes cut in the side are used. It should be done as often as every two hours in severe cases with profuse excoriating discharges, less often in the milder cases.

If a fountain syringe is not at hand or difficulty is experienced in its use, a piston syringe may be substituted.

The patient should keep the mouth open during the procedure and the irrigation should be directed first to the side most obstructed, so that a damming up behind the obstruction will not force the fluid back into the Eustachian tube.

If irrigation is objected to, **applications** gently made with a swab and sprays must take its place. Calomel may be insufflated.

Where there is much **hemorrhage** from the nose, adrenalin in dilution of 1 to 2,000 to 3,000 may be used; in some cases dry packing of the nares is necessary or if that fails the gauze used for packing may be saturated with adrenalin, 1 to 3,000.

Cardio-Vascular Apparatus. The prophylactic treatment of circulatory failure lies in the promptness and thoroughness of the serum treatment.

No complication in diphtheria, excepting laryngeal involvement and its sequelæ, is so grave as that which includes the circulatory apparatus.

One may distinguish an **early** and a **late form of circulatory disturbance.** The early form manifests the same evidences of circulatory inefficiency as one sees in any other acute infection and is in the main due to the same cause, namely, a vaso-motor failure, referable particularly to the vaso-motor center. However, it must be said that such experimental evidence as we have points to a greater implication of the cardiac muscle in diphtheria than in the case of the other acute infections; but still, it is the vaso-motor center that has to be chiefly considered in this disease too.

What has been said about the cardio-vascular apparatus in discussing scarlet fever (see Chap. IX), is applicable in all details both with reference to its etiology, its symptomatology and its treatment here, and the reader may consider that discussion as referred to this subject.

These circulatory disturbances may come on at any time in the first two weeks, depending on the severity of the infection, but at the end of the second week up to the fourth week, seldom later there occurs a

Late circulatory failure, which has been attributed to degenerative changes in the heart, especially its nervous mechanism and has been spoken of as pneumogastric paralysis.

It comes in convalescence, at a time when other nerve degenerations are made manifest.

It is a most serious condition, often abrupt, usually first appreciated by an attack of vomiting. This becomes repeated, is accompanied by precordial distress, epigastric pain and tenderness, dyspnœa, great restlessness, sometimes a clear mind, sometimes marked cerebral disturbance, syncopal attacks, pallor, sweating, very feeble pulse, strikingly slow, though sometimes rapid and death.

Sometimes the first premonition is given by a sudden change of the pulse rate to a considerably higher or slower rate.

The early and characteristic vomiting, the cerebral disturbance, the vaso-motor implication, the association with other paralyses and its time of onset has suggested it as a manifestation of cerebral degeneration rather than essentially cardiac.

The treatment begins with efficient and prompt serum administration at the earliest moment of diagnosis; it continues by great care to avoid even slight physical exertion during convalescence in all cases that have been very toxic and especially when there have followed nerve paralyses, or there is evidence of kidney involvement.

The condition is most dire and sudden death threatens with the least exertion, such, for example, as is induced by vomiting or sitting up in bed.

For this reason absolute rest is imperative and nothing will do so much to secure it and relieve the distress and pain and anxiety as morphine, hypodermically, every four hours if needed, in such doses as to effect the purpose; e.g., gr. $\frac{1}{48}$ (0.0015 Gm) in the child of two years, gr. $\frac{1}{24}$ (0.002 Gm) to gr. $\frac{1}{16}$ (0.004 Gm) at six and gr. $\frac{1}{12}$ (0.005 Gm) or gr. $\frac{1}{8}$ (0.008 Gm) at twelve years.

Food by the mouth must be stopped as the vomiting makes its retention impossible and is perhaps aggravated by it. Such nourishment as is given must be by the rectum. Procedures of all kinds, about the mouth, nose, etc., must be decreased to a minimum.

Heat over the precordium may allay pain and distress to some degree.

There is no unanimity of opinion about drug administration in this condition.

I believe, however, that those drugs that we use in circulatory failure earlier in the disease and in other acute infectious diseases should be used here; caffeine, camphor, strychnine, which affect the medullary centers, adrenalin and digitalis. If we accept the theory of pneumogastric degeneration in this condition and fear the effect of digitalis on this structure, we may administer atropine with the digitalis, to eliminate the vagus influence, giving gr. 1/100 (0.0006 Gm) with each dose of the digitalis.

Of the **vaso-motor stimulants** I have said my favorites are **caffeine** and **camphor.** The rationale of caffeine is discussed under scarlet fever (see Chap. IX).

Camphor, while it has little obvious effect on either a normal heart or vaso-motor center, has been demonstrated experimentally to produce a stimulating effect on both when they have been depressed by poisons. Upon the heart it seems to have a marked effect on the function of irritability. Its mode of administration in circulatory failure and its results are found under scarlet fever (see Chap. IX).

An **enteroclysis** of hot salt solution ʒi to Oi (4 Gm–500 c.c.) may be of great value in collapse or on the occasion of syncopal attacks. It should be given with a rectal tube, to which is attached a Y tube, one branch of the Y being attached to a rubber tube to carry off the water, while the other is attached to the syringe. By pinching the discharge tube the amount in the bowel and its discharge can be regulated. This apparatus can be utilized with little disturbance to the patient, a matter of the greatest importance during the attack.

The hot saline raises the body heat which is subnormal as a rule and by direct contact with the mucous membrane over a considerable area affords a powerful stimulant to the peripheral vaso-motor supply of the splanchnics; thus raising blood pressure effectually. A cup of hot coffee may well be added to the saline. The temperature of the fluid should be 110° F. to 115° F.

A saline injected into the tissues, at a temperature of 100° F., that is, a **hypodermoclysis,** is another excellent stimulant.

Cold Air. The splendid effect of cold air upon the circulatory system obtains in this disease as well as in other acute infections. (See Open Air Treatment of Pneumonia, Chap. IV.)

It must be mentioned that most of the authors advise the use of alcohol as a stimulant, ℥ss to ℥i a day in divided doses in children and more in adults as a cardiac stimulant and as having some beneficial effect on the toxæmia.

I am opposed to this teaching, both because it seems irrational to add day after day to the nerve tissues undergoing the degenerative effects of the toxin a substance which is itself capable of inducing a similar process and because I do not believe it is a true stimulant.

That it has some food value can not be denied, but that it has advantages over the other class of foodstuffs in this condition is more than questionable.

Paralyses. Upon the nerve structures the poison of this disease has a selective action. Nearly all the nerves are susceptible to its action, but some more than others.

The results are rather partial disability, paresis, than total paralysis and the continuance of this disability is brief. The importance of the lesion lies in the vital significance of the nerve structure affected, such as the medullary centers or the vagus nerve.

The preventive treatment depends on the promptness with which antitoxin is administered, for once the toxin is in combination with the nerve tissue there is no known way of ousting it and antitoxin is believed to be ineffectual in achieving such a desideratum.

It depends, too, on the sufficiency of the early doses, for it seems as if the neurotoxic substance was that portion of the toxin designated the toxon, which has a less avidity for the antitoxin than the rest of the toxin particle and hence is not neutralized until the rest is satisfied.

Another preventive measure, preventive rather of the disaster than of actual nerve involvement, is to assume that the nerve may be affected and insist on absolute rest and recumbency in all but the very mildest cases and even in these to realize that risk is not eliminated.

The effects of the toxin on the nerve structures are not evident until it has time to produce a certain degree of degeneration, so that the clinical evidences of paralysis are not as a rule manifest until the end of two weeks.

The likelihood of its occurrence is increased in proportion to the severity of the disease. The earliest evidences are seen in the palate and the heart, hence, the insistency on rest and recumbency when the patient is seemingly entered upon convalescence. The plain facts of the dangers and risks in a case at this time must be told the parents of the patient if an adult or older child.

It is more common in young children, but in pure laryngeal cases is relatively rare.

The incidence of the complications is set at figures that range from 11 per cent. to 40 per cent.

Heart involvement has just been discussed.

Soft Palate. This is the most frequent of the paralyses. It is important, too, because of the difficulty of feeding in decided cases, as the food will regurgitate through the nose.

This entails feeding by gavage, through the stomach tube, which may be more readily accomplished in the adult or through the nose in a child. This manner of feeding will not be continued long, because of the brief period of paresis.

Pharynx. When the pharyngeal nerves are affected, swallowing is rendered difficult and choking may ensue. Here again, the feeding by the tube is indicated.

Respiratory Muscles. Either set, intercostals or diaphragm or both may be involved. Everything to lessen respiratory effort, such as weight of clothes or doubled up position should be avoided. Not infrequently, affection of the pharyngeal muscles and larynx occur simultaneously. Secretions collect in the bronchi or food particles gain entrance and quantities of secretions gather in the pharynx. The cough is ineffectual to expel these secretions and foreign body pneumonia threatens. The foot of the bed should be raised a trifle, but not enough for the pressure of the abdominal viscera on the diaphragm to further embarrass respiration. The secretions from the pharynx may be aspirated off with a small rubber tube and a syringe and the swab of cotton on a dressing forceps or other form of applicator may be used.

Atropine gr. $\frac{1}{100}$ (0.0006 Gm) three or four times a day may lessen the secretions. Occasional compression of the chest may help to expel the bronchial contents. The other forms of paralysis, such as the oculo-motor, the facial and that of the extremities (the upper are very rare) need no especial treatment, considering the natural progress of events.

The only drug that it seems rational to administer is strychnine, in doses of gr. $\frac{1}{400}$ (0.00015 Gm) to gr. $\frac{1}{150}$ (0.00045 Gm) at two years, and gr. $\frac{1}{100}$ (0.0006 Gm) to gr. $\frac{1}{40}$ (0.0015 Gm) at twelve years three or four times a day.

Nephritis. There seems to be a considerable difference of opinion about the frequency of nephritis in diphtheria and its clinical importance.

There is, as in every acute infection, a trace of albumin that is referable to the acute degeneration of the epithelium of the tubules and tufts; but there may also be an acute diffuse nephritis, with no constancy of lesion, that is the glomerular changes may predominate in one and the interstitial in another. There seems, however, to be a good deal of tubular involvement as a rule with an abundant albuminuria. Dropsy is rare and uræmia not common. In severe cases anuria may prove fatal. Serious kidney complications come on earlier in diphtheria than in scarlet fever, are less serious both during the disease and later. The urine should be examined daily.

The treatment again begins with early and effective serum therapy. When developed, however, it is to be treated like the nephritis of scarlet fever (see Scarlet Fever, Chap. IX), but hot packs are less well borne as, indeed, are any measures that entail much manipulation with consequent strain upon the heart.

OTHER COMPLICATIONS

Bronchopneumonia. This complication is to be particularly dreaded in the laryngeal cases which come to operation. It is to be treated like any bronchopneumonia. (See Pneumonia, Chap. IV.)

Adenitis may occur in severe angina and in mixed infections. It is treated with the application of ice and incision as soon as fluctuation is detected.

Otitis is said to occur in 4 per cent. of the cases. It may be followed by mastoiditis, sinus involvement or cerebral invasion. (For treatment, see Otitis in Scarlet Fever, Chap. IX.)

Convalescence. In no other disease must the convalescence be handled with more care and discretion.

The dangers of cardiac failure, even when there has been no clinical evidences of the involvement of that organ and even in mild cases makes it imperative to explain the situation fully to the patient or in the case of children to the parents.

If the case has been mild the patient may be propped up in bed at the end of the third week and sit up in bed at the end of the fourth and a little later be put in a chair and then allowed to walk in a few days. All this time, the effect on the circulation must be watched.

Some authors make it a rule in mild cases to allow the patient out of bed a week after the throat has cleared up especially applying the rule to adults or those in whom the tonsil alone has been mildly affected.

All, however, are in agreement that in severe cases the patient should remain in bed six or eight weeks and in no case be allowed up as long as there are signs of heart involvement.

When the patient is up **good food** and **good air** are of prime importance. For the anæmia that in some degree is sure to have followed iron may be used. Blaud's pill, made fresh, or the Vallet's mass in doses of gr. iii to gr. v (0.20–0.30 Gm) three times a day.

Strychnine in doses of gr. ¹⁄₂₀₀ (0.0003 Gm) to a child of five years and gr. ¹⁄₄₀ to gr. ¹⁄₃₀ (0.0015–0.002 Gm) to an adult three times a day.

Quinine in doses of gr. 1 (0.060 Gm) three times a day have been credited with tonic properties. It can be combined with the strychnine.

In children cod liver oil, in doses of ½ to 1 dram (2–4 c.c.) three times a day is given for the same purpose.

Release from Quarantine. A patient should not be released from quarantine until two successive cultures taken from the sites of the lesion are negative. In the larger number this occurs in a week after the throat is cleared from membrane, but it may be three, four, five or more weeks before the cultures are returned negative.

When the bacteria are persistent an effort may be made to rid the throat or nose of them by a spray, irrigation or application of an antiseptic. Holt advises bichloride 1 to 10,000 mixed with glycerine one part in eight.

If the organisms are not to be gotten rid of by such means, the cultures should be tested for their virulency.

On release from quarantine the patient should be given a bath with warm water and soap and a shampoo with the same. This should be followed by a bath of 1 to 5,000 bichloride of mercury.

Sterilization and Fumigation. The disinfection is to be carried out as in a case after scarlet fever: the washable clothing and linen should be boiled for an hour after soaking over night in carbolic 1 to 50 to 1 to 20. Mattresses, blankets, pillows and unwashable clothes may be subjected to steam under pressure. If not obtainable, submitted to formaldehyde gas.

Articles of no value and all toys should be burned or destroyed.

Articles made of metal or china ware may be immersed in 1 to 20 carbolic acid.

All the woodwork, the floor, the ceiling and walls should be rubbed down with cloths wet in 1 to 2,000 bichloride of mercury.

The room should then be fumigated with formaldehyde gas. The room must be sealed with strips of paper pasted over cracks and holes and the gas generated from one of the numerous devices on the market, such as paraldehyde candles and left closed twelve to twenty-four hours.

McCollom recommends the method of the Maine State Board of Health. This consists in putting potassium permanganate (commercial) in a pan or other receptacle and pouring over it formalin (40 per cent.). It is used in the proportions of 6½ ounces of the permanganate to 1 pint of formalin. This quantity will fumigate 500 cubic feet of space.

The room should then be repainted, repapered and recalcimined.

In case of death, the funeral should be private, the body wrapped in strong antiseptics and the coffin sealed.

Carriers. Cats and dogs may be carriers and for that reason if for no other should be excluded from the sick room. **Convalescents** who have been released from quarantine without proving by culture the absence of the bacillus or those in whom only one culture was made may be carriers. Most authors insist on three and four negative cultures to assure certainty.

Contacts. Individuals in contact with known cases.

Apparently **normal persons**; in 2 per cent. to 9 per cent. of those examined. These are far less likely to be virulent organisms than the convalescents and contacts.

Articles to which small particles of membrane have clung, dried, but remain infected.

Tonsillitis cases so diagnosed which were diphtheria. Those in whose treatment local measures and antitoxin does not clear the throat. They should be tested by animal inoculation from time to time to determine virulency. (For above, see Page in *Archives of Internal Medicine,* Vol. 7, No. 1, p. 16.)

Very recently it has been discovered that the growth of staphylococcus aureus on the affected part causes the disappearance of the Klebs-Löffler bacillus; crowds it out as it were. Staphylococcus seems to be the predominant organism in normal throats. Spraying every two hours with a virulent culture of the staphylococcus and an occasional swabbing with the same, seems from the meagre reports to promise a method of freeing the throats of carriers of their diphtheritic infection.

No such results have been reported from such treatment in the acute stages and there are theoretical considerations that speak against such an effort, when the mucous membrane is the seat of a lesion, such as the possibility of seating a pyogenic infection there. (Dewitt, *The Journal of Infectious Diseases,* Vol. 10, No. 1, p. 24.)

SUMMARY

In the case of children examine the throat as a routine in all conditions.

Taking of cultures.

In all inflammations of the throat in a child, whatsoever be the clinical diagnosis and howsoever mild, take a culture for Klebs-Löffler bacilli.

Persistent and especially bloody and excoriating nasal discharges in children demand a culture.

Laryngitis, especially of a croupy character and more particularly croup lasting into the day makes a culture necessary.

For technique of taking culture, see text.

Disposition of the family.

Other children in family kept from school.

Adults in family kept from contact with children.

Health authorities should be notified.

Authorities should inspect the school or suspected groups.

Children should be isolated and cultures taken from throats and nose.

Adults should submit to the same procedure, as they may become carriers.

All the children should be immunized without waiting for a culture.

Immunizing dose. (Read text.)

Infants	500 units.
Children	1,000 units.
Adults	1,000 units.

Children whose cultures are negative should be removed from the home if the patient remains there.

If these children can not be removed they should have the immunizing dose repeated every three weeks; every two weeks is safer. (For particulars see below under immunizing dose.)

Children having a positive culture should be isolated, but never with the patient.

If case cannot be isolated at home he should be removed to the hospital.

Room.

(See Room under summary in Scarlet Fever, Chap. IX.)

Nurse.

(See Nurse under summary in Scarlet Fever, Chap. IX.)

Special precautions to avoid infection by cough or sneeze in treating throat or nose.

Secretions should be burned at once.

Nurse should use mild sprays of boric acid 2 per cent. to 4 per cent., or half strength Dobell's solution; but no astringents.

Should receive an immunizing dose of 1,000 units every three weeks and better every two weeks.

Should avoid coming in contact with children when off duty.

Should avoid close contact with others, realizing danger of her coughing, sneezing and kissing.

Physician.

See Physician under summary of Scarlet Fever, Chap. IX.

Should use mild sprays but no astringents.

If especially exposed, as by a cough into his face, should receive an immunizing dose.

Should realize that he may be a carrier.

Precautions in the sick-room.

(See same in summary of Scarlet Fever, Chap. IX.)

Temperature of room, same as in Scarlet Fever. (See Chap. IX.)

Bed.

(See Chap. IV.)

Patient.

Must go to bed even in mildest cases on account of danger to the kidneys, and cardio-vascular apparatus.

Bath.

Soap and tepid water each day. Sponge between blankets, or in warm room.

Nightgown.

Open down side to facilitate examinations.

Diet.

For general principles see Chap. II.

For details of diet see summary of Scarlet Fever, Chap. IX.

Difficulties of feeding accruing from angina or paralysis are met by

Feeding by gavage.

- 500 c.c. (1 pint) of milk.
- 50 Gm (2 ounces) sugar. } Adult.
- 1 egg.
- Give three times a day.
- Can add cream to above mixture.

Technique of gavage.

- Adults use stomach tube.
- Children over three years nasal tube.
- Infants, stomach tube.

Rectal feeding.

- Less satisfactory, but may be necessary.

Nursing infant.

- Take from mother's breast.
- Feed with mother's milk obtained by pump or massage to assist with wet nurse's milk obtained in the same way.
- Water should be given freely and offered every hour or two.
- Fruit juice may be given made into lemonade, orangeade, etc.
- An insufficient water intake because of painful swallowing is to be met by
- Water by the rectum or Murphy drip.

Care of mouth, nose and genitals.

(See same in summary under Scarlet Fever, Chap. IX.)

Bowels.

(See same in summary of Scarlet Fever, Chap. IX.)

Dose.

Determine by

1. The severity of the disease.
2. The day of the disease when first seen.
3. Somewhat by age (Wright).

In mild cases (simple congested throat with positive culture or one patch on one tonsil)

- Give 3,000–5,000 units.

Repeat if there is no improvement in twelve hours.

In more severe cases (both tonsils involved)

- Give 5,000–6,000 units.

Repeat in six hours if there is no improvement, and repeat at six to twelve hour intervals.

In still more severe cases (spreading from tonsils onto pillars or pharynx)

- Give 8,000 units, intravenously.

Repeat at six to twelve hour intervals.

Toxic cases.

1. If a pharyngeal case is toxic.

2. If there are laryngeal manifestations, hoarse cry, stridor or laryngeal cough.
3. If in addition to pharynx nose is involved,
   Give 10,000 units, intravenously.
   Repeat dose in six or four hours.
   Watch continuously.

In malignant cases (rapid spread, marked toxemia)
  Give 15,000–20,000 units intravenously.
  Repeat at twelve, six or four hour intervals.

In severe or laryngeal cases under two years
  Give larger doses; three days ill, three times the ordinary dose (Holt).

Park as the result of a large clinical experience and from his experimental data believes a single dose only is necessary, and that the initial dose should be large.

His dosage is as follows.

	Units in case.			
	Mild.	Moderate.	Severe.	Very Severe.
Infants under 1 year	2,000	3,000	10,000	10,000
Children 1 to 5 years	3,000	5,000	10,000	10,000
Children 5 to 9 years	4,000	5,000	10,000	15,000
Persons over 10 years ...	5,000	10,000	10,000	20,000

Mode of administration.

Subcutaneously.
  Blood contents of antitoxin reaches maximum between third and fourth days.
Intramuscularly.
  Somewhat earlier.
Intravenously.
  In all severe cases.
  Blood content of antitoxin reaches its maximum immediately.
Technique of administration.
  Operator's hands, cleansed with soap and water, then alcohol or 1–1,000 bichloride.
  Skin of patient cleansed with soap and water, then alcohol or paint with Tincture of Iodine.
  Boil needle and a small length of rubber tube to attach needle to syringe and prevent breaking of needle, if child struggles.
  Syringe, boil. Use one from which plunger can be withdrawn and allow serum to be passed into the barrel.
  Expel air before using.
  Antitoxin usually sent in a syringe as a container, sterile and ready for use.
Site of injection.
  Loose tissue of back at angle of scapula.
  Loose tissue of abdominal wall.
  Buttock, especially for intramuscular.
  Basilic vein for intravenous. Compress vein lightly above.
  Draw a drop of blood to prove entrance of needle into vein, before injecting.

Evidences of improvement. (See text.)

Disagreeable and dangerous results (anaphylaxis) of antitoxin administration. (See text.)

Precautions.

- If one wishes to take great precautions he may inject one or two drops at first, and if no reaction occurs in an hour give the rest.
- Precautions in asthmatics should always be taken.
- Use concentrated and purified antitoxin.
- Give 0.2 c.c. for first dose.
- Repeat in an hour.
- Give 0.4 c.c. third dose; repeat same hourly till full dose is attained.
- Give atropine, gr. 1/100 (0.0006 Gm) at the start.
- Treatment of anaphylactic shock.

Atropine	gr. 1/50	(0.001 Gm)
Morphine	gr. 1/4	(0.015 Gm)
Adrenalin	gr. xv	(1 c.c.)

  - Expelling air from chest by brute force.

Immunizing dose.

- Infants, 500 units.
- Children and adults, 1,000 units.
- Repeat at intervals of ten days to two weeks.
- Precautions.
  - Especially asthmatics. (See above under summary.)

Laryngeal Diphtheria.

- These should include any exposed child with croupy symptoms.
- Take culture.
- Even with a negative culture suspect and watch closely.
- If croup persists by day treat as true diphtheria.
- Give 10,000 to 20,000 units and repeat in four, six, or twelve hours.
- Give into vein always, if it is possible.

Other treatment. Symptomatic.

- Inhalations.
  - Steam, using croup kettle or kindred device. (See treatment of Angina in summary of Scarlet Fever.)
  - Too long steaming may be depressing.
- Hot fomentations.
- Ice-bag to neck.
- Intubation.
- Tracheotomy. (See text.)

Fever.

- Rarely demands treatment.
- Sponge baths of luke warm or cool water.

Angina.

- Cold.
  - Ice-bags and bladders.

Ice-coil.
Cold compresses.
Heat.
Fomentations.
Applications to throat.
Irrigations.
Salt solution ʒi to Oi (4 Gm–500 c.c.).
Two per cent. boric acid solution.
Half to quarter Dobell's solution.
Technique.
Read text carefully.
Sprays.
Use same solutions as in irrigation.
Gargles.
Painful and of but very little use.
Avoid astringents.
Give cracked ice to suck.
Pain of swallowing.
Paint with 1 per cent. to 2 per cent. cocaine solution.
Foul mouth.
1–2,000 permanganate solution before the bland irrigation.

Nasal diphtheria.

Irrigations. Exercise great care lest ears become involved.
Solutions same as those used on throat. (See Angina above.)
Use glass nozzle or catheter with holes cut in sides and an irrigator or fountain syringe.
Hold just high enough to cause a gentle flow.
Frequency ever two hours in severe cases; less often in less severe.
Piston syringe may be used, lacking a fountain syringe.
Patient should keep mouth open during the procedure.
Begin first on the side most obstructed.
Swabs and sprays if irrigation can not be done.
Use same solution.

Hemorrhage from nose.

Adrenalin 1–2,000 or 1–3,000 by swab on applicator.
Dry packing.
Packing with gauze soaked in adrenalin 1–3,000 up to 1–1,000.

Circulatory failure.

Early, due to toxemia as in other infectious diseases.
Treat as in circulatory failure in Scarlet Fever. (See Chap. IX.)
Late.
Prophylactic.
Early and efficient serum treatment.
Absolute rest. Sitting up in bed may kill.
Morphine hypodermically, every four hours if needed to keep patient quiet.

Dose.
  Child of two years, gr. 1/48 (0.0015 Gm).
  Child of six years, gr. 1/24–1/16 (0.0030–0.004 Gm).
  Child of twelve years, gr. 1/12–1/8 (0.005–0.008 Gm).
  Adult, gr. 1/8–1/4 (0.008–0.015 Gm).

Stop food by mouth.
Feed by rectum.
Reduce all procedures about the patient to the minimum compatible with needs.
For precordial pain and distress.
  Heat over the precordium.
  Drugs. (See text.)

Caffeine.
Camphor.
Digitalis.
Strophanthin.
Strychnine.
Adrenalin.
} See their use under Circulatory Failure in Scarlet Fever, Summary (Chap. IX).

For those who fear the effect of digitalis on the vagus in inducing heart block, the use is advised of atropine, gr. 1/100 (0.0006 Gm) with each dose of digitalis or strophanthin.

For collapse or syncopal attack.
Hot saline rectal irrigations at 110° F.–115° F.
For technique see text.
Hypodermoclysis of salt solution ʒi–Oi (4 Gm–500 c.c.) at 100° F. ℥viii–xvi (240–500 c.c.).

Cold air.
(For the technique of open-air treatment see Pneumonia, Chap. IV.)

Paralyses.
Preventive measures.
  Early and efficient serum treatment.
  Absolute rest during danger period up to fourth week.
(Rolleston says cardiac and palatal paralyses occur in first two weeks.)
Inform the patient of the risk and the need of absolute rest.
Heart.
  (See summary under circulatory failure.)
Palatal.
  Most frequent and short duration, also early.
Feeding by gavage.
  Stomach tube in infants and adults.
  Nasal tube in children.
Pharyngeal.
  Feeding by gavage.
Respiratory.
  Lessen weight of bedclothes.
  Avoid positions embarrassing respiration such as doubling up.
  Raise bed a trifle to facilitate discharge of secretions from bronchi, but not to embarrass respiration.

  - Aspirate food particles from pharynx with rubber catheter and syringe.
  - Swab secretions from pharynx with cotton on dressing forceps or on some other applicator.
  - Occasional compression of chest to help expel bronchial secretions.
  - Atropine, gr. $\frac{1}{100}$–gr. $\frac{1}{200}$ (0.0006–0.0003 Gm) according to age to lessen secretions.
    - Give three or four times a day.
  - Face and extremities need no special treatment.
  - Nerve tonic and stimulant may be used.
  - Strychnine.
    - Dose of child of two years, gr. $\frac{1}{400}$–gr. $\frac{1}{150}$ (0.00015–0.00045 Gm).
    - At twelve years, gr. $\frac{1}{100}$–gr. $\frac{1}{40}$ (0.0006–0.0015 Gm) three or four times a day.
- Kidneys.
  - The urine should be examined each day.

Nephritis.

- Preventive.
  - Early and efficient serum therapy.
  - Treat like nephritis in Scarlet Fever. (See Summary of Scarlet Fever, Chap. IX.)
- Hot packs and other manipulations causing much handling are not well borne.

Bronchopneumonia.

Treated like any other bronchopneumonia. (See Chap. IV.)

Adenitis.

(See treatment of adenitis in Scarlet Fever Summary, Chap. IX.

Otitis.

(See treatment of otitis in Scarlet Fever Summary, Chap. IX.

Convalescence.

- Explain to the parents the danger to the heart if the patient is allowed up too soon.
- Mild cases.
  - Flat in bed until end of third week.
  - Increase number of pillows two, three, four and five.
  - Sit up in bed at end of fourth week.
  - In a few days in chair, then
  - In a few days allow to walk.
- Severe cases.
  - Six or eight weeks in bed.
  - In no case allow up while there is any sign of heart involvement.
- Food.
- Fresh air.

Anæmia.

- Iron.
- Blaud's pill (Pil. ferri carbonatis), gr. ii–v (0.15–0.30 Gm) three times a day.
- Vallet's mass (Massa ferri carbonatis), gr. ii–gr. v (0.15–0.30 Gm) three times a day.
- or
- Vinum ferri amarum ʒi–ii three times a day for children.

Tonics.

- Strychnine sulphate.
  - Dose for child of five years, gr. 1/200 (0.0003 Gm) three times a day.
  - Dose for adult.
  - gr. 1/40–gr. 1/30 (0.0015–0.002 Gm) three times a day.
- Quinine.
  - Doses of gr. i (0.06 Gm) three times a day.
  - May combine with strychnine, cod liver oil (oleum morrhuæ) for children ʒss–i (2–4 c.c.) three times a day.

Release from quarantine.

- Only after two negative cultures from the throat.
- If bacilli persist
  - Spray with bichloride of mercury 1–10,000 with glycerin one part in eight (Holt).
- (See carriers below.)
- Bath and shampoo with warm water and soap.
- Follow with bath of bichloride 1–5,000.

Sterilization and Fumigation.

- (For details see Scarlet Fever Summary, Chap. IX.)
- For method of fumigation of Maine State Board of Health see text.
- Funerals should be private.
- Body wrapped in strong antiseptic and coffin sealed.

Carriers.

- Cats and dogs, as possible carriers, must be excluded from the sick room.
- Convalescents released without culture or only one negative culture are possibly carriers.
- Individuals in contact with the patient are possibly carriers (50 per cent. to 100 per cent. of the members of the immediate family were found to be carriers; 87 per cent. of an infected school were found to be carriers).
- Bacilli in carriers should be treated for virulency to determine the danger of an individual to his environment.

Recent method.

- Spraying the throat every two hours with a virulent culture staphylococcus and an occasional swabbing with the same. Use of antitoxin does not affect the organisms.

CHAPTER XI

MEASLES

Measles is a disease affecting individuals of all ages, but particularly those in the first five years of life.

All children are highly susceptible. The only exception to this is in the first five or six months of life, during which the chances of escape in an epidemic are relatively good.

Measles is a serious disease, a fact not sufficiently appreciated by the laity and often overlooked by the profession.

The **mortality** among infants and delicate children is very high, 15 per cent. to 35 per cent. in institutions, 4 per cent. to 6 per cent. at home under better environment (Holt), and while the mortality is low among older children and adults, complications such as pneumonia and ear involvement may be highly dangerous or fatal, while the susceptibility to tuberculous invasion is greatly enhanced.

No more pernicious teaching can be imagined than that as a child will probably have measles some time, the sooner it is exposed and has it the better. The older the child is, other things being equal, the better will it withstand the disease and its complications.

It is not the measles, *per se,* that affords the danger, but the fact that it reduces the resistance of the mucous membranes of the respiratory tract to the onslaughts of the pyogenic organisms, the staphylococci, the streptococci and the pneumococci, and, as has been said, renders the soil fertile for the tubercle bacillus.

The incubation lasts from 10 to 14 days; it is highly infectious from the appearance of the first symptom; hence, precedes the diagnostic rash by several days and facilitates the spread of the infection. It is the secretions of the nose and eyes that are especially contagious and the infectivity disappears with the catarrhal discharges and so is short lived. It is not air borne, but coughing and sneezing can convey it over considerable distances. A third person coming directly from a case can convey the disease, but the virus is readily killed and is rarely conveyed by the third person, the physician or other, as is the case with scarlet fever.

Distribution of the Family. Every child directly exposed, except very young infants, are almost certain to become infected. The chances of escaping are not comparable to those exposed to scarlet fever. The young infant, being less susceptible, is still capable of acquiring the disease and as the mortality is high in this group of patients, every effort to avoid the infection should be taken. The child should be removed to another house until the period of incubation of measles has passed. The chances of isolation in the same house are almost nil in contrast to the partial success of such attempts in scarlet fever. Absolute isolation of all in contact with the patient is necessary for success.

Whether another house shall be exposed to the almost certain infection by removal to it of the other older children of the family is a question, but as the infection does not cling to the house and room, as in scarlet fever, I feel that inconvenience should not be set against a chance in behalf of any child.

Quarantine for such children may be broken at the end of two weeks, if there are no catarrhal signs, no Koplik's spot and no temperature. Three weeks would meet the demands of great precaution. Of course, all children in the infected household should be excluded from school until the patient is convalescent and the period of incubation for those who have not had the disease is passed.

Room. Fear for the eyes and for the lungs has condemned the patient traditionally to darkness and to a room deprived of air. This tradition even the profession has had great difficulty in disregarding and in no illness is the room more devoid of cheer and comfort than in measles.

Light is a most potent ally in combating infection and air is not only necessary to life, but is a most valuable therapeutic agent.

If an attempt at **isolation** is to be made, the choice and management of the room must be identical with that demanded in a scarlet fever case. (See Scarlet Fever, Chap. IX.)

It is true that the eyes have to be considered in the treatment of measles and a glaring light direct in the eyes is to be avoided; this may be done by placing the bed or moving the bed from time to time to avoid it, by letting the eyes rest on a darker surface, such as a hanging of green material by a screen or by the use of colored glasses. At the most the room should be slightly darkened. The degree of comfort or discomfort of the patient is really the best regulator of the quantity of light.

Of **air** there can never be too much. Draughts are, of course, to be avoided. The temperature is to be kept at 65° F. or 70° F., but in a toxic condition a colder air is highly beneficial, provided the body is well protected. If the cough is severe a degree of moisture, obtained by the use of croup kettles or other generators of steam may alleviate it, but the air is not to be rendered heavy with moisture. Clear cold air will often prove more efficacious; patients react differently to these measures.

When conditions permit of it, two adjoining rooms may be devoted to the patient, thus giving the opportunity for a thorough ventilation and exposure to bright sunlight to the room for the time unoccupied.

Two children sick of measles should never be treated in the same room, lest complicating diseases like pneumonia be transmitted.

The Nurse. When isolation is carried out with a view to protecting other children of the family, the nurse should be as carefully restricted to the sick room and her own room as in scarlet fever. When there are no other children in the family, such restrictions are hardly necessary. She should, however, have no direct contact with adult members who have never had the disease.

Again, in her outings, she should keep away from children, but needs no such precautions as if on a scarlet fever or diphtheria case.

The Physician. The rarity with which this disease is transmitted through the third person makes the extraordinary precautions exercised by the physician when on a scarlet fever case unnecessary, particularly if he is for a time in the open air after a visit and does not go directly from a measles case to another child.

He should, however, wear a gown in the sick room and cleanse his hands with soap and water and alcohol or other antiseptic before leaving.

Precautions in the Sick Room. While the virus is far less persistent than that of scarlet fever and diphtheria and so the danger of transmission less, one ought to observe the same precautions with reference to the infectious material contaminating the articles in use by the patient as in these other conditions. This will be found in detail under Scarlet Fever.

When there are no children in the house and isolation is not carefully observed, the soaking of the clothes in disinfectants before going to the wash, if that is done at home, need not be carried out.

Bed. For the proper kind of bed and the preparation see Scarlet Fever, Chap. IX. The covering should be light unless cold air is admitted to the room, just enough to afford the patient comfort.

PATIENT

Nightgown. Should be of linen or cotton, unless cold air is admitted to the room, or draughts can not be avoided; then the flannel nightgown is to be preferred. It should be open down the front so that the chest can be readily exposed for examination.

Bath. Great fear seems to be entertained, by many physicians, of the bath. I can not see any danger, but much good in a cleansing bath of soap and water with the sponge. If the patient is exposed, the room should be previously warmed to a little over 70° F. If concern is excited by this hygienic procedure, the patient may be put between blankets and one part after the other exposed and bathed or the patient may be sponged under the blanket. Not only does it keep the skin clean and assist the inflamed structure in its normal functions, but it is decidedly refreshing to the patient. The bath water should be lukewarm or cool.

Diet. The energy demands of the body continue during an infection as in health; for a man at rest, indeed, the demands during fever are greater, because of certain additional demands made by the pyrexia, *per se,* and by the destruction worked by the toxins of the disease.

The derangement of the functions of the alimentary canal during a prolonged and severe infection is remarkably little (see Diet in Acute Infectious Disease, Chap. II), but such as there is is more marked at the incipiency of the infection. In short acute infections, then, there is no necessity for urging food to meet theoretical demands, both because of the temporary derangement of alimentation and because of the brief period of the infection. At such a time anorexia should be respected as of conservative significance. When, however, the infection is prolonged in its regular course, or prolonged because of added, that is, mixed infection, the necessity for supplying enough food becomes of great moment.

Measles runs a short febrile course and the amount of food can be left to the patient's inclination; but if complicated by a bronchopneumonia, continuing for some time, the caloric and proteid needs must be reckoned.

In young infants on the bottle, the food should be diluted with water or thin cereal water one-half or one quarter.

In older infants the milk had better be diluted.

In older children and adults milk and gruels made of arrowroot, barley, wheat flour, cornstarch, farina or imperial granum or small quantities of the cereals themselves with milk or cream and sugar, jellies of barley, tapioca and sago, boiled rice, milk toast; or some of the other modifications of milk such as buttermilk, koumys, matzoon, afford variety. If the fever continues, add bread and butter, eggs, custard, scraped beef, vegetable soups. As the fever becomes normal, add small quantities of scraped beef, raw oysters, chicken or squab, finely minced. The additions are made in convalescence of the shorter attacks.

For the caloric values of articles here mentioned, see Scarlet Fever, Chap. IX.

Water is to be administered freely. It is to be given whenever asked for, but it is also to be offered during each waking hour. Plain or alkaline waters, lemonade, orangeade, imperial drink, may be used. The latter may be sweetened freely, every ounce of sugar adding 120 calories of food.

The administration of water is too often neglected, while it is infinitely more important than many drugs, the intervals of whose administration is jealously observed by physician and nurse.

Skin. A warm cleansing bath is given each day and a second may be given if it adds to the patient's comfort.

Often there is a good deal of **itching** and **burning.** This may be relieved by sponging with a solution of **sodium bicarbonate,** ʒi to 3 pints (4 Gm to 1,500 c.c.) of water or dabbing on bran water, made by putting a handful of bran in a muslin or cheesecloth bag and moving this about in a gallon (4 liters) of water until it becomes milky. For more severe itching 1 per cent. to 2 per cent. carbolic acid (phenol) in oil or vaseline may be used.

When desquamation begins the body may be anointed with vaseline after the daily bath.[1]

℞—Phenolis	gtt. xx–xl (1.3–2.6 c.c.)
Pulv. zinci oxidi	
Pulv. amyli	
Pulv. calaminæ	āā ʒii (8 Gm)
Glycerini	ʒij (8 c.c.)
Aq. calcis	q.s. ad ℥iv (120 c.c.)

M. Mop on or apply cloths wet with the solution. Do not rub.

Mouth. When one considers that the most common and serious complications of measles is due to the presence in the mouth of pyogenic organisms, the staphylococci, streptococci and pneumococci, which have invaded the air passages to the production of bronchitis and bronchopneumonia, one appreciates the importance of measures aimed at keeping the mouth and nose clean.

After each meal the mouth should be rinsed with normal **salt solution** (ʒi to the pint) (4 c.c.–500 c.c.) or 2 per cent. to 4 per cent. **boric acid** solution of ½ or ¼ strength **Dobell's** solution. Swabs on wooden tooth-picks, saturated with the same solutions, should be used to cleanse the teeth and the spaces between the teeth and cheeks or lips. For **sordes** or coated tongue, half strength **peroxide of hydrogen** (official) may be applied first, the tongue gently scraped with the edge of a whale-bone and the solutions mentioned then used.

If the mouth is dry equal parts of 2 per cent. boric acid and vaseline with a little lemon juice affords a pleasing application.

Sprays of the same solutions should be used for the throat. Gargles are not efficacious for this purpose.

Nose. Dried secretions should be moistened with sweet oil and then cleansed with the same solutions as the mouth. The swab on the tooth-pick may be used for these purposes. Sprays of the same materials should follow.

Eyes. The eyes should be cleansed twice a day, or oftener, if needed, with saturated boric acid solution. Vaseline may be smeared on the edges of the lids to prevent gluing.

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[1] Hubbard recommends for itching, if much surface is involved, the prescription cited.

The **genitals** should be attended to and kept free from irritating secretions, using the saline or boric acid solutions.

Bowels. When first seen a free catharsis should be given. To the infant or very young child, **castor oil,** ʒi to ʒii (4–8 c.c.) or calomel, gr. $\frac{1}{10}$ to gr. $\frac{1}{4}$ (0.006–0.015 Gm) at 10 to 15 minute intervals until 1 grain (0.060 Gm) is taken. In older children and adults, **salts,** Epsom, Rochelle, Sodium phosphate in doses of ʒii to iv (8–15 Gm) in $\frac{1}{2}$ glass of water, alone or preceded by calomel gr. i to gr. iss (0.060–0.10 Gm) in divided doses.

To children Liq. magnesii citratis ℥vi to viii (180–240 c.c.) is more grateful or milk of magnesia ℥ss (15 c.c.) following the calomel.

The bowels should be moved by an enema or liq. mag. cit. or Hunyadi water at least every other day.

Fever. A moderate degree of fever, that is 104° F. or below is to be let alone or even 105.5° F. if only for a few hours. As a rule measles is not accompanied by greater degrees of fever than these mentioned and the course is short. When, however, a sudden impulse of temperature to 106° F. or above occurs or a temperature of 104° F. to 105° F. persists, an effort should be made to reduce it. Craster has shown that the liability to a fatal issue increases directly as the temperature.

Drugs should not be used for this purpose. Nothing equals **cold water** as an antipyretic.

For young infants **sponging** is the best, for children the **pack** or sponge and for older children and adults the pack or **bath.**

The younger the child, the warmer the water used. **Baths** for children should be graduated. The water used in these procedures should begin at 95° F. to 98° F. and be gradually reduced to 85° F. or lower, depending on the reaction of the patient and the fall in temperature. One should be satisfied with a fall to 102° F. and at this point intermit the procedure. Ice to the head adds to the efficacy of the other measures.

If there is any sign of collapse during the bath, one should take the patient out, wrap him in warm blankets, put heat to the extremities and give warm drinks.

If with a high temperature the extremities are cold, the patient's color poor and pulse small, the hot mustard bath should be given with ice applied to the head.

The **mustard bath** is made by using mustard in the proportion of a tablespoonful to the gallon. Put the mustard into a small part of the water at a tepid temperature to cause the formation of the oil from the mustard, then add the rest of the water, in a few minutes bringing it up to the temperature of 100° F. After the child is immersed to the neck, warmer water to bring the whole to 105° F. can be added if desired. The child may be left in five to ten minutes, then dabbed dry, rolled in a warm blanket, with heat at the feet and ice at the head.

Cardio-Vascular. Except in the rare instances of malignant measles and in bronchopneumonia as a complication, the heart does not demand serious attention. When, however, the circulation fails in this condition, the same causes may be deemed operative as in other acute infections, and the same measures should be undertaken to combat it. These are dealt with at length under scarlet fever. In no way is the treatment modified because the infection is measles instead of scarlet fever.

As most of the cases are infants or young children, the doses should be suitable for them; **caffeine** gr. ⅛, ¼, or ½ (0.008–0.015–0.030 Gm) in the form of one of the soluble double salts of salicylate or benzoate every two or three hours, **camphor,** gr. ⅕ to gr. ½ (0.012–0.030 Gm) in oil 10 per cent., adrenalin (1 to 1,000) for sudden collapse, m. ii to m. iii (0.150–0.20 c.c.) into a muscle.

For respiratory failure these same drugs and atropine gr. 1/400 (0.00015 Gm).

Nervous Symptoms. In the severe cases the cerebral manifestations may be pronounced; restlessness to delirium and even convulsions or there may be stupor.

These expressions of toxæmia in the cortex of the brain are to be combated like those impinging on the vaso-motor and respiratory centers at the base, by the use of **hydrotherapy.**

The **warm sponges** and **baths** for sedative effects and the colder one for stimulating. These **baths, sponges** and **packs** are to be used as described under the section on Fever.

An **ice cap** to the head has a quieting effect.

If these measures are not efficacious or not attainable and drugs must be used, in very young children **antipyrin** in doses of 1 grain (0.060 Gm) and sodium bromide in doses of gr. iii to gr. iv (0.20–0.25 Gm) three or four times a day may be tried. In older children of five or six bromide in doses of gr. v (0.30 Gm) three or four times a day, in adults gr. xv to gr. xx (1–1.30 Gm) at the same intervals. Phenacetin in doses of gr. i to gr. ii (0.060–0.125 Gm) to young children may prove sedative, repeated as with the others.

For **sleeplessness** in children, the **baths** and the small doses of **bromides** and **antipyretics** mentioned are the best.

In adults **trional** in gr. x (0.60 Gm) doses and **chloralamid** in doses of gr. xx (1.30 Gm) may be used and repeated in two or three hours if needed.

For wild **delirium,** sacrificing sleep and rest, **morphine** will be necessary, hypodermically, gr. ¼ (0.015 Gm) in the adult, gr. 1/16 (0.004 Gm) in the older children, gr. 1/24 to gr. 1/48 (0.003–0.0015 Gm) in the younger.

COMPLICATIONS

Bronchopneumonia. Of the serious complications of measles bronchopneumonia is far and away the most common and is responsible for the great majority of the fatal cases.

In private practice the incidence of pneumonia is given at about 10 per cent., but is much more common in institutions. The mortality is very much higher, too, in hospitals than in private practice. In the hospital a child with pneumonia should be promptly removed from the environment of the simple cases, as the condition will spread readily among the cases. An abundance of air, close attention to the toilet of the mouth and avoidance of exposure of the body to draughts and chilling are prophylactic measures.

Most of the cases occur in the first five years of life and the mortality is many times higher in infants under two than in the older children of the first lustrum.

The appearance of bronchopneumonia in a case of measles changes the whole aspect of the case. The treatment henceforth is that of pneumonia, modified not at all by the fact that it complicates measles.

The patient must be kept in **bed,** unless a young infant, when it may be taken up from time to time. The older patients in bed must be turned from time to time to avoid hypostasis and encourage the discharge of secretions. The **temperature** of the **room** should be kept from 65° F. to 70° F. unless the cold air treatment is instituted when especial provision in making the bed should be made. As the temperature is more sustained and as an additional toxæmia must be combated, more frequent sponging adds to the comfort and refreshes the patient. The care of the **mouth** must be carried out more rigidly than ever and if the breath is foul or there is stomatitis a carbolic solution such as the following should be applied:

℞—Phenol (Watery solution 1–20)
Boric acid (sat. watery sol.) ....āā ℥i (30 c.c.)
Glycerin .... ℥viii (240 c.c.)
M.

The **diet** should be more liberal than at the beginning, to meet the caloric needs, adding at least 25 per cent. to the requirements in health. (See Scarlet Fever, Chap. IX, for the caloric requirements.)

The importance of the ingestion of a sufficiency of water must be emphasized, offering it every hour.

Open Air Treatment. A considerable experience with this mode of treatment has made me an enthusiastic advocate of it. The results are so striking and so satisfactory that it is tragic that the physician who is convinced is so handicapped by the traditional fear of the cold entertained so largely by the laity. The most enthusiastic party concerned is the patient. It must be emphasized, however, that the technique must be correct and carefully carried out. Precise instructions about the making of the bed, the protection of the patient, the watchfulness of the nurse, must be given. Detail is set forth in the article on Pneumonia, Chap. IV.

Improvement is seen in the lessening of the nervous symptoms, better sleep, improved appetite, better pulse and respiration.

Objections are made to the cold air treatment in the case of very young and delicate children and in cases of capillary bronchitis. Certainly, watchfulness must be more vigilant in these cases. As for the capillary bronchitis, some react exceedingly well to the open air treatment, while others do not do so well. The response of the individual case must be studied.

Next in value to the cold air in the combat with toxæmia is **cold water.** It may be applied in the shape of cold chest **compresses,** cold **sponging,** the graduate **bath,** beginning at 95° F. and reducing to 85° F. or the evaporation bath.

In the early stages **mustard paste,** one part of mustard to five or six of flour in infants and one in four in older children, depending more or less on the reaction of the skin, may be applied. These may be applied every 4, 6 or 8 hours. (See Pneumonia, Chap. IV.) Poultices and jackets add weight and are of little value.

Fever. Continuous high temperature is exhausting. Its effects are to be met by frequent **sponging** with tepid water, or, if the degree of toxæmia is marked with the colder applications, sponges, **packs** or **baths.**

Hyperpyrexia calls for extraction of heat, as explained in the preceding section on fever.

Cough. This is likely to be severe in the cases with much bronchitis. In some the effects of the **open air** is highly satisfactory, in others the application of the **chest compress,** but many show an increase of the cough or a "tightening" of the breathing, that finds relief in a warmer, moisture laden air. The effects of **steam** from a croup kettle in a tent made with a sheet over the upper part of the crib, or over a clothes horse or screen often has a happy effect. If the results of the plain steam are not satisfactory, compound tincture of benzoin, or creosote may be added, a teaspoonful upon the water of the kettle. A degree of moisture may be obtained by water heated in shallow dishes elsewhere in the room. It is not desirable to load the atmosphere of the room with steam. It and the heat generated are depressing, nor should the child be kept too long under the tent. The room should be thoroughly aired two or three times a day, the child being removed to an adjoining room during the ventilation.

A harassing cough sacrifices rest and sleep. It must be met by small doses of **codeine,** gr. 1/24 (0.003 Gm) to gr. 1/12 (0.005 Gm) in children according to age, in older children and in adults gr. 1/8

(0.008 Gm) to gr. ¼ (0.015 Gm) every two hours. Holt advises **Dover's powders** in doses of gr. ⅒ (0.006 Gm) every two hours to a child of one year.

I have no great faith in expectorants and fear the disturbance to the stomach they may set up.

When the secretions are abundant or the child is weak, efforts at expulsion may be ineffectual. **Hot and cold water alternately** applied, or **hot mustard baths** may excite to increased respiration and save from a threatened suffocation. **Oxygen** may be used diluted with air and the **chest cupped.**

Delirium and **sleeplessness** are ameliorated by the effects of **cold air.** A **warm bath** sometimes invites to sleep. An **ice bag** to the head is often helpful. For **headache** and **extreme restlessness, antipyrin,** gr. i (0.06 Gm) or phenacetin gr. i (0.06 Gm) or gr. ii (0.15 Gm) or **Dover's powders** gr. ⅒ (0.006 Gm) to infants and larger doses to older children every three or four hours.

Care of the diet and bowels and sufficiency of water are of prime importance when respiration is embarrassed, as the formation of gas produces **tympanites**; the gas presses up on the diaphragm and encroaches on the breathing space and disturbs the heart action. To relieve this **mild salines** as suggested, **enemata,** or **enteroclyses** of warm salt solution, **fomentations** (see Typhoid Fever, Chap V), the introduction of a **rectal tube** or a **Murphy drip** may be of value.

Cardio-vascular failure has been dealt with under that heading above. For **œdema** of the **lungs** the same measures as advised in suffocative bronchitis just described may be undertaken.

Bronchitis. Much more common and far less alarming as a complication is bronchitis in measles. In fact, a certain degree of bronchitis may be anticipated in a well developed case. The treatment has been outlined under pneumonia, for all gradations of bronchitis are to be met with merging insensibly into pneumonia and all severe cases of bronchitis, involving the bronchi of small size are to be considered as and, indeed, are pneumonia.

For the milder grades, one may try as described above, **mustard pastes,** the **chest compress, inhalations of steam** or steam medicated with **benzoin, creosote** or **eucalyptol,** the latter especially when the secretions are thick and viscid.

For the cough, if severe and exhausting, **Dover's powder** or **codeine** in doses described.

Laryngitis. A laryngitis may occur early or late. When occurring early it probably is not diphtheritic, but a culture of the throat should be taken. **If occurring late it probably is diphtheritic** and should be treated as such, not awaiting upon the return of the culture which is to be made, but giving **antitoxin** at once, 10,000 units.

Occurring early it is to be **treated like laryngitis** under other conditions.

Local Applications. Heat or **cold** in the shape of **compresses,** though to apply cold the **ice bag** or **coil** may be used, but are not so easy of application as the compress.

Cold Compress. Old linen cut into a strip folded three or four times lengthwise long enough to go about the neck and pin. Wring out of cold water at 60° F. Apply to the throat and outside of this a dry flannel. Renew hourly.

Hot Compress. A thick piece of old flannel. Lay it in a crash towel, pour over it boiling water, wring it in the towel by twisting the ends in opposite directions, flirt in the air to expel the excess of hot steam, apply, and outside of it a dry flannel, renew every ten or fifteen minutes for three or four times and apply dry flannel. Repeat at three or four hour intervals.

Inhalations. Steam from a croup kettle under the tent as above described. Compound tincture of **benzoin, turpentine** or **eucalyptus oil** may be added, ʒi (4 c.c.) upon the water of the kettle.

Warm drinks and warm milk. A glass of hot milk in the morning will often relax the parts and aid to expel the secretions. If the secretions are thick and the patient old enough to permit it, **sprays** of **sodium bicarbonate,** gr. xx to the ounce (1.30 Gm to 30 c.c.), telling the patient to inhale as the spray is injected, will "cut" the secretions and help to discharge them. Sprays in an oily medium, as **benzoinol,** of menthol, eucalyptus or camphor 1 per cent. or a combination of each 1 per cent. may be found grateful.

If the **cough** is harassing, small doses of **codeine** as for bronchitis may be administered.

Otitis. Measles is second to scarlet fever only in the frequency of ear involvement. It is said to be affected in 10 per cent. of the cases, but the degree of impairment and the seriousness of the sequelæ is much less. Nevertheless the ear should be regularly inspected. The treatment is in the application of **dry heat,** 5 per cent. carbolic (phenol) in glycerine to relieve the pain and incision when bulging is obvious. For details of the treatment, see Scarlet Fever, Chap. IX.

Adenitis. Marked involvement of the cervical glands occur in some 2 per cent. of the cases. For treatment, see Scarlet Fever, Chap. IX.

Ulcerative Stomatitis. Noma. Both these conditions may complicate measles. The latter, though fortunately rare, is more commonly a complication of measles than of any other disease. Not only is it highly fatal, 70 per cent. to 100 per cent. in different series, but if it spares, it leaves a lamentable deformity and scarring of the part affected, most often the face. Its relation to ulcerative stomatitis is believed to be close, and it is believed that the noma represents a more virulent process in a less resistant individual than does the ulcerative stomatitis. Both are probably due to the fusiform bacillus of Vincent.

It is for this reason that such great care should be exercised on the oral toilet in measles.

When ulcerative stomatitis occurs, in addition to measures advised in the care of the mouth, one should administer **chlorate of potash,** gr. ii (0.130 Gm) every one or two hours and use a chlorate of potash solution as a mouth wash; the strength should be ¼ per cent. to ½ per cent. or if this is painful more dilute. If the process is not bettered by these efforts one may touch the spots with 10 per cent. **nitrate of silver.**

If the process is succeeded by noma or begins as a noma one uses as an irrigation **potassium permanganate,** making a claret colored solution, and has recourse to more heroic measures in addition to those named.

The edges of the gangrenous process is touched with **fuming nitric acid** or with pure **carbolic acid** (phenol) followed by pure alcohol. The gangrenous tissue should be previously clipped away or the edges curetted.

The best opinion, however, favors **free excision,** going out into the healthy tissue, and applying the **Paquelin cautery** to the edges. This should be done before the toxæmia has robbed the patient of what little resistance may be left.

MacGuire recommends the application of a thick paste of **subnitrate of bismuth** and water at frequent intervals. I have seen most intense ulcerative stomatitis clear up under this treatment.

In a hospital the child affected should be removed from the ward and **isolated,** as the disease seems contagious.

Noma may attack the vulva and is to be similarly treated.

Gastro-Intestinal. As the rash fades or in convalescence an ileo-colitis may occur and is often of serious import. It should be treated as under other circumstances. During the early hours no food should be given, but water freely, in small quantities frequently; then the **diet** should be barley water, arrow-root water, rice-water, broths, chicken, mutton, veal or beef broth. The broths may be thickened with farinaceous foods, barley, arrow-root, wheat flour. When the acuteness of the symptoms have passed and decided improvement in the stools have occurred milk in the shape of boiled skim milk may be begun, cautiously at first.

The bowels should be moved with **castor oil,** ℨi (4 c.c.) to a child of a year and more in accordance with age. The colon should be irrigated daily with saline solution, ℨi to a pint (4 Gm–500 c.c.), using 2 to 3 quarts (2–3 liters), at 100° F. This will often suffice, but if the stools persist, **bismuth subnitrate** in doses of gr. xx to gr. xxx (1.30–2 Gm) every two hours, should be given, the dose decreased with improvement in the stools. It can be given, shaken in a little water, through which it quickly diffuses in suspension.

The drug is insoluble, hence, the large doses can be given to the child as well as the adult. The object is to give enough for it to exert its protective effect on the considerable extent of the gut involved. The castor oil should be repeated every two or three days. If oil can not be retained **Rochelle salts,** ʒi to ʒiv (4–15 Gm) can be substituted.

Only when the gut is certainly clean and when the diarrhea resists other measures should **opium** be used, in children in the shape of paregoric, m. v (0.30 c.c.) equal to gr. 1/48 opium (0.0015 Gm) or its equivalent in powder, tincture or Dover's powder, every two or three hours. Lengthen the interval promptly with improvement. The temptation to use opium early and to continue it instead of seeking more legitimate measures of relief must be strenuously combated. In severe pain or copious exhausting diarrhea, **morphine** hypodermically, gr. 1/48 to gr. 1/24 (0.0015–0.0003 Gm) at a year to two years may be used. For lesser pains of a colicky nature fomentations should be applied to the intestine.

Diet rather than drugs should afford relief.

Eyes. More or less conjunctivitis is common enough and is to be treated with frequent applications of **boric acid** solution, 2 per cent. to 4 per cent. If severe, **cold cloths,** squares of linen or cheesecloth may be applied frequently and over a considerable period of time. These cloths are put on bits of ice in saturated boric acid solution and constantly renewed, as they grow warm upon the eyes. The lids are kept separated with vaseline smeared along the edges. In purulent conjunctivitis silver salts may be used, such as argyrol.

In only the weakly and ill nourished patients may one anticipate the serious complications, an involvement of the cornea with ulceration. These cases need expert advice.

In **blepharitis** apply yellow oxide of mercury ointment, gr. i (0.060 Gm) of oxide to ʒii to iv of vaseline (8–15 Gm).

If there is much **photophobia** a drop of atropine in ½ per cent. solution can be applied to the eye to dilate the pupil. Use cautiously.

The eyes must be shaded or the room somewhat darkened.

Heart complications, such as endocarditis or pericarditis are very rare and are to be treated as under other circumstances.

Kidney involvement, other than a transient albuminuria, is an uncommon occurrence. If nephritis does occur it is to be met as in scarlet fever. (See Scarlet Fever, Chap. IX.)

Diphtheria. As has been said, any membrane on the tonsils, or pharynx should demand immediate culture to determine whether it is diphtheritic or not, to be treated accordingly. If laryngitis intervenes in the course of measles, **antitoxin** should be given, 10,000 units, without awaiting the report on the culture. In the hospital all cases should receive an immunizing dose of antitoxin.

Tuberculosis. Measles renders the patient peculiarly susceptible to tuberculosis, making readily possible an infection or lighting up of an old process or causing the breaking down of and extension from tuberculous bronchial glands. Cough and fever persisting should lead to repeated careful examinations of lungs and sputum. Other tuberculous complications, such as meningitis and acute miliary tuberculosis may follow. Such possibilities again heighten the importance of sedulously avoiding infection.

Convalescence. The most important matter in consideration of the period of convalescence is the susceptibility to tuberculosis. Avoidance of exposure to a tubercular environment or prompt removal from one, in case any member of the family has or is suspected of having tuberculosis; avoidance of colds, plenty of **fresh air,** an abundance of **good food** and tonics, the last in fact the least, constitute our efforts. One may administer iron, **Blaud's pill** or **Vallet's mass** in doses of gr. ii to gr. v (0.130–0.30 Gm) three times a day according to age, or the **bitter wine of iron,** which contains 5 per cent. of the citrate of iron and quinine, in doses of ʒi to ii (4–8 c.c.) three times a day. **Strychnine** or **Tr. nux vomica,** in doses according to age and **cod-liver oil.** This latter is best administered to children without effort to conceal the taste, in doses of ʒss to i (2–4 c.c.) in older infants, and ʒi to ii (4–8 c.c.) in children.

The child should be kept in bed until the rash has quite disappeared and then in the absence of fever or complications may be allowed up and in another week or ten days be allowed out.

Release from Quarantine. The patient should be given a warm bath with soap and water and a bath of bichloride 1 to 5,000. The hair should be shampooed.

Disinfection. The virus of measles does not cling to rooms or articles long. If the room occupied is thoroughly cleansed and aired for some days and children are not allowed to occupy it for two or three weeks, the rigorous disinfection given to a room after scarlet fever is not necessary, but in an institution or when children must occupy the room, such rules as laid down for disinfection in scarlet fever should be carried out. Such precautions will always appeal to the careful parent.

Clothes and utensils may be disinfected as in scarlet fever. (See Chap. IX.)

SUMMARY

Distribution of the family.

Exposed children are almost sure to catch the disease; still they ought to be isolated until the incubation period is passed, i.e., two weeks, then kept away until the patient is well.

Young infants have a greater chance to escape, and their isolation is the more imperative.
Exposed children should be kept from school until the patient has convalesced and the incubation period is passed.

Room.

Choice and management.
(See summary under Scarlet Fever, Chap. IX.)

Eyes

May be protected by the position of the bed.
By the use of screens.
By the use of colored glasses.
By slightly darkening the room.
Patient's comfort the best regulator of light.

Fresh air.

Temperature of room 65° F.–70° F.
In toxic condition, cold air, with body properly protected. Two rooms adjoining—one to be exposed to fresh air and sunlight, when not occupied, is excellent.
Never treat two patients in the same room on account of the contagiousness of the complications.

Nurse.

Must have no contact with other children or susceptible adults either when she is on duty or during her hours off duty.

Physician.

Should not go directly to another child.
Wear gown and gloves in sick room.
Wash hands on leaving with soap and water.
Follow with alcohol or 1–1,000 bichloride.

Precautions in sick room.

(See summary under Scarlet Fever, Chap. IX.)
If there are no other children in the family, soaking clothes in disinfectant before going to the family wash is not necessary.

Bed.

Choice and preparation.
(See summary under Scarlet Fever, Chap. IX.)

Patient.

Nightgown, cotton or linen, or if cold air is admitted, flannel.
Open all the way down the front or sides to facilitate examinations.

Bath.

Soap and tepid or cool water.
Between blankets, if desired.
Room temperature 70° F. or over during the bath.

Diet.

- Do not urge food during early days.
- During short course of a normal measles leave quantity to the patient's inclination.
- When prolonged by complications the proteid and caloric needs must be considered.
- (See Chap. II and Chap. V.)
- Young infants.
  - Dilute the milk mixture one quarter to one half with water or thin cereal water.
- Older infants.
  - Milk had better be somewhat diluted.
- Older children and adults.
  - Milk gruels of arrowroot, barley, wheat-flour, cornstarch, farina or imperial granum or small quantities of cereals with milk, cream and sugar, jellies of barley, tapioca and sago, boiled rice, milk toast, milk modifications, eggs, ice cream. As the fever declines, bread and butter, custard, raw oysters, chicken and mutton broths, thickened with rice, arrowroot, etc. With normal temperature scraped beef, squab, chicken, lamb chop minced.
- Water freely.
  - Alkaline waters, lemonade, orangeade, imperial drink.
  - Fruit juices may be sweetened.
  - (For caloric values see Typhoid Fever, Chap. V.)

Skin.

- Cleansing bath each day.
- Itching and burning.
  - Bicarbonate of soda ʒi to Oiii water (4 Gm to 1,500 c.c.).
  - Bran water dabbed on skin.
  - A handful of common bran in a cheesecloth or muslin bag swished about in a gallon of water until milky.
- When more severe.
  - One per cent. to 2 per cent. of phenol in vaseline or olive oil.
- When desquamation begins.
  - Anoint with vaseline after daily bath.

Mouth.

- (For details see summary under Scarlet Fever, Chap. IX.)

Nose.

- Moisten dried secretions with sweet oil.
- Use swabs on wooden toothpicks as applicators or sprays of same solutions as in mouth.
- Physiological salt solution ʒi to Oi (4 Gm–500 c.c.).
- Two per cent. boric acid solution.
- Quarter to half strength Dobell's solution.

Eyes.

- Cleansed twice a day or oftener.

- Use saturated (4 per cent.) boric acid solution.
- Anoint the lids with vaseline to prevent sticking.

Genitals.

- Keep clean with 2 per cent. to 4 per cent. boric acid solutions.

Bowels.

- When first seen.
- Infant or very young child.
  - Castor oil ʒi to ʒii (4–8 c.c.).
  - or
  - Calomel, gr. $\frac{1}{10}$ to gr. $\frac{1}{4}$ (0.006–0.015 Gm) every ten to fifteen minutes until gr. i (0.060 Gm) is taken.
- Older children and adults.
  - Salts. Epsom, Rochelle, Glauber's or Sodium phosphate ʒii to ʒiv (8–15 Gm) in half glass of water. Give alone or preceded by calomel, gr. i to gr. iss (0.060–0.10 Gm) in divided doses.
- Children.
  - Liquor magnesii citratis ℥vi to ℥viij (180–240 c.c.) or milk of magnesia ℥ss (15 c.c.).
- Later.
  - Move bowels at least every other day by enema, liquor magnesii citratis or Hunyadi water.

Fever.

- When moderate, below 104° F. let alone.
- Hyperexia.
  - Sustained above 104° F., or sudden above 105° F., use cold water.
  - Infants, sponge.
  - Children, pack or sponge.
  - Older children and adults; bath or pack.
  - Baths for children, if given, should be graduated.
  - The younger the child the warmer the bath.
  - Begin at 98° F. to 95° F. and cool down to 85° F.
  - Be satisfied when patient's temperature falls to 102° F.
  - Keep ice-bag, cold cloths, to head or sponge head with cold water.
- Collapse during bath.
  - Wrap in warm blankets.
  - Heat to extremities.
  - Hot drinks.
- High temperature, cold extremities, bad color and small pulse.
  - Mustard bath.
  - ℥ss (15 Gm) mustard to 1 gallon (4 liters) water.
  - Add mustard to a small amount of luke warm water to develop the oil, then add hot water to 100° F.
- Put child in.
  - Bring temperature up to 105° F.
  - Leave in five to ten minutes.
  - Dab dry and roll in warm blanket.
  - Put heat to feet and ice bag to head.

Circulatory failure.

- (See Scarlet Fever, Chap. IX.)

Nervous symptoms.

- Delirium.
  - Warm baths or sponges.
- Sponges, packs, baths. (See above under Fever.)
- Ice bag to head.
- Drugs.
  - Only when other measures are not efficacious or attainable.
- Young children.
  - Antipyrin, gr. i (0.060 Gm) three times a day.
  - Phenacetin, gr. i to ii (0.060–0.150 Gm).
  - Sodium bromide, gr. iii to iv (0.20–0.25 Gm) three times a day.
- Older children.
  - Sodium bromide, gr. v (0.30 Gm) three or four times a day.
- Adults.
  - Sodium, potassium or ammonium bromide or any combination of these, gr. xv to gr. xxx (1–2 Gm) three or four times a day.

Sleeplessness.

- Children.
  - Warm baths.
  - Bromides.
  - Antipyrin.
  - Phenacetin.
  - } As above under Delirium.
- Adults.
  - Trional, gr. x to xv (0.60–1 Gm) as a powder or in warm water, whisky, brandy or wine.
  - Repeat in two hours if needed.
  - Chloralamid, gr. xx to gr. xxx (1.30–2 Gm) in powder or cold water (heat decomposes) or wine, whisky or brandy, and repeat in two hours if needed.

Wild delirium.

- Morphine hypodermically, gr. $\frac{1}{48}$–$\frac{1}{4}$ (0.0015–0.015 Gm) according to age.

Complications.

- Bronchopneumonia.
  - Remove from the ward or other cases to prevent its spread to others.
  - Treat as a pneumonia.
  - (See Pneumonia, Chap. IV.)
  - (See text.)
  - It includes
    - Cold air.
      - Watch cases of capillary bronchitis.
      - They often do better in a warmer air.

- Early stages.
  - Mustard paste to whole chest every three or four hours.
  - (For technique see Pneumonia, Chap. IV.)
- Fever.
  - Sponges, packs and baths of cold water.
- Cough.
  - Open air.
  - Chest compresses.
- Steam inhalations under tent.
  - Benzoin.
  - Creosote.
  - Water left in shallow dishes in room for moisture.
  - Don't get air too moist.
  - Remove child once in a while to air the room.
  - Codeine, gr. $\frac{1}{24}$–$\frac{1}{4}$ (0.0025–0.015 Gm).
  - Dover's powder, gr. $\frac{1}{10}$ (0.006 Gm).
    - Every two hours at one year (Holt).
  - Expectorants not advised.
  - Feeble expulsion of secretions.
  - Applications alternately of hot and cold water.
  - Hot mustard baths. (See above.)
  - Oxygen inhalations diluted with air.
  - Cupping chest.
  - Changing position from time to time.
  - Give water freely.
- Tympanites.
  - Mild salines.
  - Enteroclysis.
  - Murphy drip.
  - Rectal tube.
  - (See Typhoid Fever summary, Chap. V.)
  - Fomentations.
  - (For technique of above measure see Pneumonia, Chap. IV.)

Bronchitis.

Treat like a mild pneumonia.

Laryngitis.

- Early; probably not diphtheritic.
  - Culture should be taken, however.
- Late; probably diphtheritic.
  - Give antitoxin at once, 10,000 units, preferably into vein.
- Early.
  - Heat.
    - Compresses, Technique. (See text.)
  - Cold.
    - Compresses, Technique. (See text.)
    - Ice coil.
    - Ice bag.
  - Inhalations.
    - Steam.

  - Steam medicated with compound tincture of benzoin, oil of eucalyptus or turpentine, ʒi (4 c.c.) to the pint (500 c.c.) water.
  - For technique see Scarlet Fever, Chap. IX.
- Warm drinks, especially in the morning.
- Sprays.
  - Bicarbonate of soda, gr. xx to ℥i (1.30 Gm–30 c.c.).
- Sprays of oils.
  - Menthol.
  - Eucalyptus.
  - Camphor.
    - Individually or in combination in 1 per cent. strength.
- For cough.
  - Codeine gr. $\frac{1}{24}$ to ¼ (0.0025–0.015 Gm) according to age.

Otitis.

- Daily examination of the ears.
- For earache.
  - Dry heat.
  - Five per cent. phenol in glycerine. Drop in ear.
- Bulging.
  - Incise.
- (For details and technique, see Otitis in summary of Scarlet Fever, Chap. IX.)

Adenitis.

- (See Adenitis in summary of Scarlet Fever, Chap. IX.)

Ulcerative Stomatitis.

- Usual solutions for cleanliness.
- Chlorate of potash gr. ii (0.15 Gm) in water internally every two hours. (Doubtful importance.)
- Chlorate of potash ½ per cent. to ¼ per cent. solution locally mouth wash.
- Silver nitrate 10 per cent. to 25 per cent solution—touch ulcers.
- Tr. Iodine.
  - Paint on ulcers.
- MacGuire's method; see below under Noma.

Noma.

- Irrigate with potassium permanganate (make deep claret red solution).
- Clip away gangrenous tissue or curette the edge.
- Touch the edge after curetting with fuming nitric acid, or pure phenol, followed by pure alcohol.
- Better yet free excision, cut into healthy tissue and touch edge with Paquelin cautery.
- MacGuire's method; cover affected area every two or three hours with a thick paste of water and subnitrate of bismuth. Remove child from other cases.

Noma of vulva.

Treat in same way as noma in mouth.

Gastro-Intestinal.

Ileo-Colitis.

Stop food during early hours.

Give water in small quantities very frequently.

Then

Barley-water, arrowroot or rice water, mutton, veal or beef broth, then thicken with farinaceous foods, barley, arrowroot, rice, wheat flour, then as stools improve add boiled skim milk and gradually get back on diet.

Castor oil, ʒi to ii (4–8 c.c.) at one to two years.

Colon irrigation to be given daily.

Use salt solution ʒi to Oi (4–500 c.c.) 2 to 3 quarts at 100° F.

If loose stools still persist give bismuth subnitrate gr. xx to gr. xxx (1.30–2 Gm) every two hours, the interval being lengthened as stools decrease. Give it shaken in a little water.

Castor oil should be repeated every second or third day.

If oil is not retained give,

Rochelle salts ʒi to iv (4–15 Gm).

If above measures fail, and only when the gut has been thoroughly emptied by the cathartic, give

Opium, gr. $\frac{1}{48}$ (0.0015 Gm) or its equivalent m. v (0.30 c.c.) paregoric or equivalent amounts in tincture or Dover's powder. Lengthen intervals with improvement.

Copious and exhausting movements.

Morphine hypodermically gr. $\frac{1}{48}$ to gr. $\frac{1}{24}$ (0.0015–0.0025 Gm) at one to two years.

Colicky pains.

Fomentations; technique, see Typhoid Fever summary, Chap. V, or Dysentery, Chap. VI.

Very severe pain.

Morphine hypodermically gr. $\frac{1}{48}$ (0.0015 Gm) at one year to gr. $\frac{1}{24}$ (0.0025 Gm) at two years.

Eyes.

Conjunctivitis.

Careful cleansing with saturated boric solutions.

If severe.

Cold cloths, i.e., squares of linen or cheescloth, wet in boric acid solution and kept cold on ice until used.

Apply vaseline to margins of lids to prevent sticking.

Purulent conjunctivitis.

Irrigation with boric acid solution.

Instillation of silver salts, e.g., argyrol.

Ulcers of cornea.

Should seek expert advice.

- Blepharitis.
  - Yellow oxide of mercury, gr. i to ʒii or ʒiv vaseline (0.30 to 8 or 15 Gm).
    - Smear on lids.
- Photophobia.
  - Shade eyes or darken room.
  - Atropine to dilate the pupil, ½ per cent. solution. Use cautiously.

Heart complications rare.

- Treat as under other circumstances.

Kidney complications rare.

- Nephritis.
  - Treat as in Scarlet Fever. (See summary, Chap. IX.)

Diphtheria.

- If there is a membrane on the tonsils, take a culture.

Early laryngitis.

- Take a culture.

Late laryngitis.

- Give antitoxin 10,000 units into vein. Don't wait for return on culture.
- Hospitals give all cases an immunizing dose.
- (See Diphtheria, Chap. X, for treatment.)

Tuberculosis.

- If cough and fever continue, suspect tuberculosis.
- Examine lungs repeatedly.
- Examine sputum repeatedly.

Convalescence.

- Avoid exposure to a tuberculous environment.
- Avoid taking cold.
- Fresh air.
- Good food.
- Drugs.
  - Iron.
    - Blaud's pill, better Vallet's mass in capsule gr. ii to v (0.15–0.30 Gm) three times a day.
    - Vinum ferri amarum (bitter wine of iron) ʒi to ii (4–8 c.c.) three times a day.
  - Strychnine gr. $\frac{1}{200}$ to gr. $\frac{1}{60}$ (0.0005–0.001 Gm).
  - Tincture of nux vomica m. i–x (0.06–0.60 c.c.), according to age, three times a day.
  - Cod liver oil.
    - ʒi–ii (4–8 c.c.) three times a day.
- Allow up.
  - When rash and fever are gone.
- Allow out.
  - A week or ten days later.

Release from quarantine.

Give bath of soap and water.
Follow with bath of bichloride 1–5,000.
Give shampoo.

Disinfection.

Room cleaned and aired for a few days.
Put no children in this room for two or three weeks.
The cautious parent and institutions will prefer disinfection as in Scarlet Fever. (See summary, Chap. IX.)
Clothes and utensils may be disinfected as in Scarlet Fever. (See Chap. IX.)

CHAPTER XII

RUBELLA

(GERMAN MEASLES)

RUBELLA may be considered the mildest of the exanthems. Such importance as it has rests on the fact that mild cases of scarlet fever or measles may be mistaken for it and entail great risk to others.

It is hardly safe to make a diagnosis of German measles in an isolated case. In an epidemic the diagnosis is relatively easy.

In isolated cases or in the early cases of an epidemic it is much safer to isolate the case and treat it as a scarlet fever suspect until the appearance of further cases settles the doubt.

This disease occurs much more frequently in adults than any of the exanthems, though it is rare after middle life.

The incubation period is from two to three weeks.

Isolation. Many physicians think it hardly necessary, so mild is the disease and so very rare the complications, but if the physician, like the author, believes no infection is so trivial as to be neglected, other children will be sent away, if that can be done without exposing other children and will be kept from school until the period of incubation expires, that is three weeks. If this is not done these "contacts" should be watched, and with any evidence of catarrh, trivial at the most, or with frank enlargement of the glands of the neck, they should be isolated.

The fever is, with the rarest exception, of little moment and complications so unusual as to be suspected of being coincidences.

It is well to have the patient keep the bed during the few days of temperature; allow out of bed a couple of days after and out of the house in a couple of days more.

Sponge baths once or twice a day for cleanliness and comfort, moving the bowels at the beginning with calomel or salts or both and avoiding constipation after, making the diet fairly liberal, milk and milk products, broths, gruels, bread and butter, toast, cereals, eggs, rice, custards, ice cream during the febrile period and meat and vegetables after the febrile period, giving water, or lemonade freely, taking care of the mouth, by the use of boric acid or Dobell's solution constitute the treatment.

Fresh air and sunlight and good nursing is the sum total of treatment.

There is scarcely the necessity for the rigid fumigation and disinfection one carries out in scarlet fever and measles.

If the room is thoroughly cleaned and thoroughly aired for a few days, it meets all the requirements. If disinfection is done, the rules may be found under scarlet fever, Chap. IX.

SUMMARY

Isolation.

- Contacts should be kept from other children until the incubation period of three weeks are passed.
- Because the disease is so trivial protest is made against keeping contacts from school through incubation period.
- At least, the slightest sign of catarrh or enlargement of cervical glands should demand isolation.
- In sporadic cases isolation is imperative, because cases so diagnosed are repeatedly mistaken diagnoses of mild Scarlet Fever.

Bed.

- If there is fever, keep patient in bed until gone.

Baths.

- Sponge of soap and water for cleanliness.

Bowels.

- Move at the beginning with castor oil ʒi to iv (4–15 c.c.). Calomel in divided doses gr. ¼ (0.015 Gm) every quarter hour for four doses.
- Follow by salts ʒi to iv (4–15 Gm) or salts, Epsom, Rochelle or Glauber's alone in same doses or Liquor magnesii citratis ℥vi to viij (180–240 c.c.) or milk of magnesia ℥ss (15 c.c.).

Diet.

- Fairly liberal.
  - During fever milk or milk products, broths, gruels, bread and butter, toast, cereals, eggs, rice, custard, ice cream.
  - Water, lemonade, orangeade, Imperial drink, freely.

Care of mouth.

- Use boric acid solution, 2 per cent. to 4 per cent., or
- Dobell's solution, half to quarter strength.

Fresh air.

- Allow out of bed two days after fever subsides.
- Allow out in two days more.
- Cleanse room and air it thoroughly.

CHAPTER XIII

VARICELLA

(CHICKEN POX)

Varicella is essentially a disease of childhood and is so because it is so contagious that few children avoid it; but adults who have so far succeeded in doing so are equally susceptible when exposed. The contagion is usually direct, but it may be conveyed by a third person, particularly if the conveyance is immediate.

Distribution of the Family. It is so trivial in its effects that much disturbance of the family to effect isolation seems hardly warrantable and, moreover, other children are pretty sure to have been infected before the disease is recognized; for, as a rule, the first suspicion of its presence is aroused by the eruption. There are, however, exceptions to the statement just made and that in the case of delicate children. Mild though it be in the vast majority of instances, it is possible for it to run a severe course and unexpected and rare complications may ensue. We would not willfully, therefore, expose children and the children of the family should be kept from other children to prevent the spread of disease and that, of course, means that children should be kept from school. Some writers say it is warrantable to let children attend school for the first ten days after exposure, but that ought to mean only when the first exposure is certainly known and when there is no contact of the school child with the patient.

Contacts, if removed from the patient, should be kept from other children until the period of incubation has passed, which should be considered in such cases as three weeks.

Room. A light and well aired room should be chosen for the patient and isolation may not be so strict as in the more severe exanthems, unless any individuals are coming into contact with other children.

The physician can convey the disease, though with a thorough airing and avoidance of visiting a child immediately, it is not likely to happen.

Patient. If there is no fever nor malaise, as is frequently the case, confinement to the bed is unnecessary, but if either of the above mentioned conditions obtain, the patient should remain in bed.

When the eruption is abundant a regular cleansing bath can not be given without the risk of breaking and infecting the vesicles, an accident which it is desired to prevent.

The **diet** in the light case need in a properly fed child be scarcely modified. If fever of a light grade is present, all but solid foods may be given; if, as rarely happens, the fever is high, food should not be forced, for the fever will subside in a day or two. In the meantime, milk and milk preparations and farinaceous gruels may be given.

Water should be allowed freely.

Skin. The one object of real consideration is the skin; for the nature of the eruption leads to scarring, which on the face, especially of a girl, is to be rigorously avoided.

The eruption itches, the young child scratches and even older children, who endeavor to avoid doing so are sure to lacerate some of the vesicles inadvertently or in their sleep and infect the lesions, causing an increased damage to the skin and in some instances setting up erysipelas.

The eruption should be kept as dry as possible and **dusting powders** of sterile talcum powder or equal parts of starch, zinc oxide and boric acid may be used for this purpose.

In young children the **scratching** can be **avoided** by putting the arms in splints, by putting on stiff card-board cuffs, reaching well above and below the elbows, thus preventing the bending of the arms and scratching of the face. Less efficacious, but less trying for the little one, are wrapping the hands in gauze and cutting close the nails.

When **pustules** form, especially on the face, they should be evacuated by incising the edge of the pustule with a small spear pointed lancet or a Hagedorn needle, squeezing out the pus and in very bad ones irrigating with a fine pointed dropper with rubber bulb attached, using boric acid or diluted peroxide of hydrogen, half to quarter strength. The vesicle should not be denuded.

Some men advocate painting the vesicles with equal parts of tincture of iodine and alcohol as a protective.

To control the **itching** the skin may be dabbed with a solution of bicarbonate of soda 1 dram to the pint (4 Gm to 500 c.c.) or stronger, or 1 to 5 per cent. phenol in sweet oil or vaseline be applied. In intense itching even 10 per cent. is used, but only over confined areas.

In severe cases there may be some stomatitis. The mouth should be cleansed after each feeding and a mouth wash of salt solution .6 per cent., Dobell's solution half strength, or 2 to 4 per cent. boric acid solution used as a preventative.

Bowels. When first seen the child should be given a mild saline, milk of magnesia ʒii–iv (8–15 c.c.), or Liquor magnesii citratis ℥iv to viii (180–240 c.c.).

Constipation should be avoided by a repetition of the dose or an enema.

Fever. The fever is so slight as to require no treatment as a rule. In the rarer cases cold air or dabbing the skin carefully with cool water or an evaporation bath might be tried.

Nervous symptoms are largely due, when they occur, to the irritation of the skin. The applications to the skin advised allay them in a measure, but bromides in doses of gr. v to gr. x (0.30–0.60 Gm) according to the age, two years to ten years, are indicated. This may be repeated every four to six hours.

Complications. Any complication is unusual, but now and then **stomatitis** (for treatment see Measles, Chap. XI) **conjunctivitis** (for treatment see Measles, Chap. XI) nephritis (for treatment see Scarlet Fever, Chap. IX), and erysipelas occur.

Convalescence is rapidly established and if it has been a severe attack iron may be indicated as a tonic, but in my estimation fresh air and food are far better for such a purpose.

Release from Quarantine. The patient may be considered as no longer a source of infection when the last scab has dropped off. By this time he is ready to go out and is allowed to do so after a thorough cleansing bath and shampoo.

Disinfection. The room needs only good cleaning and airing for a few days.

SUMMARY

Distribution of the family.

Rare for any member of the family to escape it.
Usually is so light that isolation of other children is hardly advisable.
Exception should be made in the case of sickly children, who should be removed from the environment of the patient.

School.

Some physicians let exposed children go to school for ten days but only when date of first contact is surely known.
Contacts should be kept from other children for three weeks, the incubation period.

Room.

Light and well aired.

Physician.

Wash hands on leaving case.
Avoid seeing another child at once.

Patient.

Should go to bed, if there is fever or malaise; otherwise, not necessary.

Bath.

Can not be given when the eruption is abundant as the vesicles may break and become infected.

Diet.

There need be little change from the usual unless there is fever; then exclude solids.
Water should be given freely.

Skin.

Danger of scarring on the face.
Keep eruption dry.
Use sterile talcum powder or

℞ $\left.\begin{array}{l}\text{starch}\\ \text{zinc oxide}\\ \text{boric acid}\end{array}\right\}$ equal parts.

To keep young children from scratching and infecting, put cardboard splints around the arms at the elbows, or wrap the hands in gauze, or cut the nails short.

Treatment of pustules.

Evacuate by incising edge of pustules with small lancet or Hagedorn needle. Gently syringe out pus.
Irrigate the bad ones with a fine pointed dropper, using boric acid solution, or
Peroxide of hydrogen, quarter to half strength.

Itching.

Bicarbonate of soda solution.
Phenol, 1 per cent. to 5 per cent. in olive oil or vaseline.
If severe, 10 per cent. over a limited area.

Stomatitis.

Mouth cleansed after each feeding with
Physiological salt solution ʒi to Oi (4 Gm to 500 c.c.) or
Dobell's solution, half strength, or boric acid solution, 2 per cent. to 4 per cent.
(See Measles, Chap. XI.)

Bowels.

When first seen a mild saline of milk of magnesia ʒii to iv (8–15 c.c.) or Liquor magnesii citratis ℥iv to viii (120–240 c.c.).

Fever.

Cold water dabbed on skin.
Cold air.

Nervous symptoms.

Usually due to itching.
Apply sedatives to the skin (see above).
Bromides gr. v to x (0.30–0.60 Gm), according to age, every four to six hours.

Complications.

Stomatitis.
(See Measles, Chap. XI.)
Conjunctivitis.
(See Measles, Chap. XI.)
Nephritis.
(See Scarlet Fever, Chap. IX.)

Convalescence.

Fresh air.
Abundant food.
Iron, i.e., bitter wine of iron (vinum ferri amarum) ʒi–ii (4–8 c.c.) three times a day after meals.

Release from quarantine.

When the last scab has come off.
Give a cleansing bath and a shampoo.

Disinfection.

Clean and air the room.

CHAPTER XIV.

PERTUSSIS

(WHOOPING COUGH)

By the layman whooping cough is looked upon as a disease of lesser significance, an annoying inconvenience rather than a danger; by the physician in general, in spite of the statistical evidence of its high mortality, its gravity is not duly appreciated. Measles and whooping cough are exceedingly dangerous diseases when attacking young children under two years, but the low mortality among the older children seems to determine the attitude of the public to the disease in general.

Whooping cough is highly contagious; few children exposed to it escape the infection and the incidence of the disease among the very young, six months and under, a period which seems to enjoy a relative immunity to many of the other infections of childhood together with the frequency of bronchopneumonia of severe grade and the difficulty of feeding when vomiting is frequent, makes it a disease to be dreaded and by every possible means averted.

Unfortunately, the very period during which it is most contagious is that in which it displays nothing characteristic to afford a warning of its real nature and permit of avoidance, for in the early or catarrhal stage, it is looked upon as a coryza and a tracheitis or bronchitis, until the persistency of the cough, its periodicity, its paroxysmal character or the vomiting accompanying the paroxysm give the hint of the real condition, while the one or two weeks of this stage has offered abundant opportunity to infect all susceptible individuals who are in contact with the patient. When the paroxysmal or whooping stage has arrived the infectivity has materially diminished, some good authorities think has passed, though such an opinion seems to me at the present time not sufficiently substantiated to act upon.

Excellent results with the complement fixation test make it urgent to utilize it, in suspected cases, when other children are endangered, provided the technique of the reaction can be properly carried out.

Distribution of the Family. As has been said the long delay of the diagnostic symptoms during the most infectious stage makes infection of other children almost certain when whooping cough has not been expected, but in the presence of an epidemic, the first signs of coryza or the first cough should make the individual a suspect and measures for protection of the other children be taken. So serious is this condition to infants and to weakly children that the attempt should be made under any circumstances to prevent infection. The most efficacious means is by removing the other children to another house, unoccupied by children or if that can not be done, to endeavor to preserve a quarantine of the affected case in the house. This last is especially difficult, because of the long course of the disease and because of the unwisdom of cooping up in the house the infected child, who has no complications.

The children who are removed from an infected house become suspects and must themselves be isolated until the period of incubation of the disease has elapsed. The incubation is usually set as one to two weeks, but to avoid the exceptional case these "contacts" should be isolated for three weeks.

The mode of infection is by direct contact, the organism being borne in the fine spray of a cough or sneeze or even in all probability in the act of laughing and talking. It is to be remembered, however, that it is possible for a third person to carry the disease, when the conveyance is rapid; this is important to remember, when the mother or other person in contact with the patient may be tempted to go from one to the other.

Another important fact to be kept in mind is that the infection can undoubtedly be conveyed in the open air and realizing the carelessness of nurses and mothers, too, in taking the affected children about, when allowed out, in the presence of an epidemic young infants should be kept from gatherings of children and decidedly so if any of them are coughing.

Sill urges the prophylactic use of vaccines in children who are exposed.

He has used it in doses of 25,000,000 to 75,000,000 at weekly intervals, of one to three doses with gratifying results.

Room. A large room with the possibilities of light and air should be chosen or a room opening off a balcony, verandah or even fire-escape. It is well when the opportunity affords to select two rooms opening into each other; this to permit of frequent ventilation, by changing the patient from one to the other. It is possible that the rooms become so infected that the patients reinfect themselves, so that disinfection of the room with a formaldehyde candle, lamp or other contrivance, every few days is advisable.

Too much fresh air one can not have, but draughts, high winds and dust are to be avoided.

Open air is most desirable, and the patient can be kept on the balcony a good part of the time, but in the colder weather, the frequent attacks of coughing, that must displace the coverings, as the child sits up, makes it less feasible than in other infections of the bronchial tree. Where such exposures are frequent it is well to keep the **temperature** about 70° F., not allowing it to go much below 65° F.

Clothing should be flannel next the skin whether in bed or up and about to avoid the chill that comes from wet clothing drenched with the sweats after a paroxysm and from the frequent exposures.

Overclothing, which keeps the skin perpetually moist and enhances the possibilities of bronchial involvement and burdens the chest, is to be avoided.

Those children who are very young, very weak or have considerable bronchitis have to be watched with more care in the open air and many good men prefer to keep them to the room at an even temperature, with frequent ventilation.

Nurse. Considering how highly contagious the disease is and that adults as well as children are susceptible to it, it is hardly just to ask a nurse to take a case of pertussis unless she has already had the disease, for while the danger to an adult is minimal, the length of time that she would be debarred from exercising her profession would work an injustice.

The nurse should realize that while rare, still direct conveyance of the disease through the third person is possible and should avoid contact with other children while off duty.

While on duty the nurse should not leave her patient, especially if it is a young child or infant, for suffocation may occur in a paroxysm or a convulsion may ensue.

Physician. The physician should avoid the small risk of conveying the disease by wearing a gown and washing his face and hands on leaving the sick room. He should not make his next visit on a child unless some little time in the open air intervenes.

If he himself has not had the disease, he should be careful not to stand directly in front of the patient during a paroxysm, unless there is some special need. Perhaps a mask, like a chloroform mask over the nose and mouth, the gauze or cover of which has been wet with 1 to 20 carbolic acid may help in avoiding infection.

Precautions in the Sick Room. Strict isolation to the quarters assigned the patient, as long as he is confined to his room, and when the patient is permitted to go out of doors careful avoidance of contact with other children is the rule to be observed.

All **secretions** are to be received on cloths and burned or into receptacles and sterilized.

Bed linen, night clothing, towels and so forth should not be sent to the family laundry until it has been boiled an hour separately or allowed to soak over night in 1 to 20 carbolic acid.

Cats and dogs are believed to carry the infection and are to be excluded from the sick room. Two children should not be treated in the same room.

Bed. For treatment in the open air the bed is made in a special manner, see Pneumonia, Chap. IV.

All patients with whooping cough are not to be confined to bed. The indications for remaining in bed are the presence of a febrile reaction or any serious complication.

In this disease the nerves are particularly affected and trivial excitation can precipitate the paroxysm; among these the slight chill from being put into a cold bed.

Baths. A cleansing bath should be given every day with soap and tepid water. This may be done on a blanket or between the folds of a blanket, exposing only one part at a time.

Diet. For older patients with the milder form of attack, who are not confined to the house, no material change in the diet need be instituted, provided, of course, that the diet is suitable for a child of a given age.

It is the association of vomiting with the paroxysms and the gastro-intestinal complications that may occur that make feeding in whooping cough a difficult problem.

When there are no serious complications, gastro-intestinal or pulmonary and the vomiting entails merely a loss of food ingested, the deficit can be made up by a little tact and perseverence.

After the explosion of the paroxysm of coughing with which the vomiting is so closely associated, there is a period of quiescence for both the organs of respiration and digestion.

One should take advantage of this to offer food, so that as large a portion of the meal as possible may be digested and passed along into the intestinal canal before the next paroxysm is due.

On the other hand, as the time for the succeeding paroxysm draws near, the ingestion of food excites the coughing reflex and precipitates the paroxysm.

When the paroxysms become very frequent, every hour or every half hour, no considerable period is left between paroxysms for gastric digestion; then the problem is to introduce such food as requires a brief stay in the stomach and carries with it a maximum amount of fuel.

In early childhood and infancy the staple article of diet is milk, plain or modified, and when one remembers the physiology of milk digestion, the precipitation of the curd, the digestion at the periphery and the three hours required for its complete removal from the stomach, one sees the benefit accruing from small quantities of milk taken frequently, thus affording the maximum surface for digestion and the use of means or methods that lessen the bulk of the curds. Among these measures are dilution with water, half and half affording the optimum for rapidity of digestion, or the use of lime water, 1 in 20 or the use of a cereal water, barley or arrowroot as a diluent instead of plain water, or the use of milk gruels, using barley, wheat flour, rice, arrowroot, or some of the malted or farinaceous foods used for infant feeding, or whey, buttermilk, koumys, or predigested milk or animal broths may be given or their food value added to by thickening with farinaceous foods, custards baked or soft; jellies or gelatin carrying sugar, junket, soft egg or albumin water, but always in giving these liquid foods, some estimate must be made of the amount of fuel value they represent in the twenty-four hours, for too often is it forgotten that considerable bulks of liquid food may be ingested that have almost no energy value, for example, animal soups and broths.

Wet toast, milk toast or softened rusks may be added. No dry food should be given, lest the particles irritating the pharynx precipitate the attack of coughing.

In infants on milk mixtures, the dilutions should be increased, and the feedings made in smaller amounts at more frequent intervals.

In the worst cases with gastro-intestinal indigestion, every effort is set at naught and one has recourse to rectal feeding, but with small hope that it will be borne sufficiently long or be attended with sufficient success to more than meet short-lived emergencies.

Care of the Patient. In the lighter cases, going out of doors, only the daily bath in the morning, flannel next the skin, taking care not to overclothe, ordinary oral hygiene and cleansing the nose with sprays of boric acid solution 2 per cent. or Dobell's solution quarter strength or with the same applied on a swab of cotton, with destruction of the secretions during the catarrhal stage are all the measures indicated. When serious complications of the respiratory tract or of the alimentary tract ensue, the care of the mouth is of great importance.

Bowels. Unless there are complications the bowels are to be kept open with mild cathartics, such as cascara in the older children and milk of magnesia in the younger.

Fever. The fever in uncomplicated cases is so trivial as to require no treatment; it is, however, an indication for keeping the patient confined to the bed.

Cough. The paroxysmal cough is the characteristic symptom of pertussis. The frequency and severity of these paroxysms determine in no small measure the prognosis in the disease.

Not only is the cough in itself exhausting, but in the severe cases it may be responsible for suffocation, convulsions or cerebral hemorrhages. More than this it is accompanied by vomiting, so frequent at times that it is absolutely incompatible with adequate nutrition and in the very young and weakly is the lethal factor.

Efforts in the treatment of whooping cough are largely directed to the diminution of the number of paroxysms, to afford rest and make possible a sufficient feeding.

The great desideratum is a specific treatment. Some steps have been taken to accomplish this and will be touched upon presently, but results are not as yet such as to displace the older empirical treatment.

There is no reason to believe that any of the empirical measures used heretofore shorten the disease; they merely ameliorate the condition of the patient; hence, if the disease is mild and the paroxysms relatively infrequent, no treatment should be given other than that determined by the hygienic and dietetic measures already laid down.

If we can avoid drugs we should do so, for it must always be remembered that a drug does many things to the organism besides that which we particularly desire and some of these drug effects are deleterious, as for example, the disturbance of digestion in a disease in which so much depends on the stomach. In cases of moderate severity we may, then, with advantage, see what local measures effect before having recourse to medication.

LOCAL PROCEDURES

Mechanical Support. Few simple devices have been rewarded with more success than the one recommended by Kilmer, the application of an elastic belt to the abdomen, chest or both.

The support given by this contrivance lessens the vomiting in no small measure and modifies the frequency of the paroxysm. It finds its greatest application in infants and weakly children with poor abdominal tone, such as obtains in rickets. Kilmer's instructions are as follows: "A stockinette band is placed upon a baby . . . in the same manner as is done by orthopedists before applying the plaster-of-Paris jacket. This band extends from the axilla to the pubes and fits the baby snugly. Two shoulder straps are used to prevent the band from slipping down. Upon this stockinette band a single width of elastic bandage is sewn, extending entirely around the body and covering the abdomen. The bandage is sewn on when very slightly on the stretch." If the vomiting is not controlled the belt may require a little tightening. The effect is particularly noticeable on the vomiting. A similar elastic bandage may be sewed on the stockinette to cover the chest and diminishes the number of paroxysms. These may be worn separately or together.[1]

All forms of excitement and highly emotional states should be avoided; gentle persuasion in nervous children exerted, which while it can not abort a true paroxysm, may lessen the cough often suggested to the child which precipitates a paroxysm. Fresh air, avoidance of dust, prevention of chilling by exposure to draughts, cold beds, etc., constitute no mean part of the treatment.

Numerous sprays, local applications to the air passages and insufflations have been advised. They are of more than doubtful efficacy, while they often excite and alarm the child and aggravate the condition.

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[1] "Whooping Cough—A New Method of Treatment." Theron W. Kilmer. *New York Medical Journal.* June 20, 1903.

Inhalations. Inhalations of medicated steam will sometimes lessen the number and severity of the paroxysms and lessen the cough of bronchitis, occurring between the paroxysms or render more liquid and easy of discharge the mucus of a bronchitis.

It must be remembered that fresh air is of first importance in whooping-cough and that it should not be sacrificed to long inhalations, which themselves from the heat and dampness may become depressing.

Again it must be remembered that one case may find more relief from one agent than from another, or that better results are afforded by occasional change of the medicament employed.

One may try the **compound tincture of benzoin** first, three or four times a day, more especially at night, when the paroxysms are likely to be worse and sacrifice sleep, or the frequency and length of time may be determined by the degree of relief afforded.

A dram or two of compound tincture of benzoin is placed upon the surface of hot water; the drug is carried with the steam and inhaled.

Simple devices may be used, such as a pitcher, a caraffe, or a simple kettle to contain the hot water, a cone of paper arranged over the mouths of the vessels or the spout of the kettle. If the latter is used, it may be kept steaming and a rubber tube attached to the spout may be attached at the other end of a funnel, to facilitate the inhalation.

Croup kettles of various designs may be used, but one must always be on the sharp lookout for fire when the alcohol lamp is used. Electric heaters are of course to be preferred when accessible. Of the different designs of croup kettle my choice is for one made by Lewis and Conger of New York on designs of Holt. It adds safety to convenience.

The inhalations are altogether more efficacious if given under a **tent.** There are numerous ways of contriving this; ropes or bandages about the four posts of the bed, or where posts are lacking improvised posts at the corners of laths or canes, over which a sheet may be thrown. A sheet may be thrown over an open umbrella. It is better that the whole body should not be included in the tent, only the head. This can be done by arranging four improvised posts, two on each side, a little way apart, connected by rope or bandage with a sheet or rubber sheet over them.

Next to benzoin try **creosote.** This may be given in the same way, a dram on the surface of the hot water used in any of the receptacles mentioned, in the way mentioned. In some of the croup kettles, such as Holt's, a sponge carried in the spout receives the creosote and the steam passing through the sponge conveys the vapor of the drug.

Chloroform. When the paroxysms are frequent or severe, threatening convulsions, or asphyxia, a few drops of chloroform on a handkerchief, sponge, towel or the hand should be given to inhale.

Other Measures Advised. Nägele has advocated pulling the jaw down and forwards, after the manner of the anæsthetists, to interrupt the laryngeal spasm.

Smith, quoted by Ker, says that prolonged spasm may be broken by plunging the infant's hands into cold water.

In the most severe form of spasm, intubation may be necessary and does afford relief. For technique see Diphtheria, Chap. X.

For inhalation one may try **oil of eucalyptus**, in the same proportions as the benzoin, or menthol gr. xv in ʒi to ii (1 Gm in 4–8 c.c.) of compound tincture of benzoin as recommended by Holt or cresolin, two or three times in the twenty-four hours. There is on the market a special form of vaporizer for cresolin.

Drugs. No end of drugs have been recommended to relieve the paroxysms of pertussis, which in itself constitutes the proof of their very limited value.

The condition to be attacked is a hyperexcitability of the neuromuscular apparatus of the larynx, as well as a general nerve excitation. It would seem rational, then, to select drugs that have a sedative effect on the nervous system and those are the drugs that have been shown empirically to be the most efficacious. It must be remembered, however, that these drugs all have undesirable effects as well, the most of them being depressant to the circulation and so should not be used indefinitely or recklessly. Again it is to be remembered that individuals react differently to the different drugs and if results are not obtained after full dosage, it is better to try another rather than keep on with the first in hopes that the action is merely delayed.

My own preference is for the drug especially advocated by Holt and now used very extensively, antipyrin.

Antipyrin. This drug is easily soluble in water and has a slightly bitter taste, but hardly enough to make it desirable to disguise the taste. It should be given in liberal quantities.

Holt advises for a child six months old gr. i (0.060 Gm) every three hours and, if there are no untoward symptoms increase the dosage up to every two hours. At a year one may begin with a grain and a half (0.10 Gm) and at two years gr. ii (0.125 Gm) every four to six hours, the dosage being increased up to every two hours.

As the paroxysms are as a rule worse at night, one can with advantage combine with the antipyrin sodium bromide, in doses of gr. ii (0.125 Gm) at six months, gr. iii (0.20 Gm) at one year and gr. iv (0.25 Gm) at two years to be administered in the latter part of the day and night.

By some it is deemed advisable to stop the drug after a week, having recourse to some other drug, as bromide for a few days, alternating by periods with antipyrin.

The drug is contraindicated in weakly children with impaired circulation or with pneumonia.

Bad effects rarely come from such dosage as is advised unless the patient has an idiosyncrasy for the drug.

The most common idiosyncrasy is marked by an erythematous eruption or localized œdema. More rarely one sees evidences of collapse, pallor, weak pulse, low temperature and cyanosis, but this is less common and less marked than after acetanilid.

The continuance of the drug must depend on results and the reaction of the child to the drug.

Belladonna. No drug has enjoyed a reputation for efficiency in pertussis comparable with belladonna. Belladonna is ranked as an antispasmodic and its pharmacology is sufficiently worked out to justify this classification. Its effects on motor nerve endings supplying smooth muscle structures explains its good effects in many forms of spasm, but will not explain the results obtained in the spasm of the striped muscles of the larynx. Pharmacologists have not adequately explained its clinical results in this disease.

Cushny has suggested that perhaps it owes its efficacy to its content of hyoscine operating to depress the irritability of the respiratory center. If this is true, one would not substitute atropine for the Galenical preparations of the drug. It is possible that a depression of sensory nerve endings in the mucous membrane of the trachea affected may play a rôle.

Two facts must be kept in mind in using the drug to control the paroxysms. (1) That it has to be used to the physiological limit, that is, to the point of the earliest toxic manifestation to get results; and (2) that there are many individuals that have an idiosyncrasy for this drug; hence, the beginning dose must be small, a tentative dose.

The most consistent advocate of this treatment is Jacobi, whose definite instructions in the usage of this drug in his editor's note to the article on Pertussis in *Modern Clinical Medicine* can not be improved upon and which I quote here.

Taking the case of a child of two years, he says, "Give 6 drops of Tr. Belladonna three times a day; unless the drug cause a 'feverish' flush on the cheeks within half an hour, which must last half an hour or more, it has no effect. If 6 drops have no such effect, give 7, 8, 9 or more every time. The effect must be attained **every time,** three times daily. Give as many drops as are required to accomplish that end. After a few days more drops will be required.

After about a week the full dose will probably have to be doubled."

I would advise before starting with so large a dose as advised by Jacobi that a small dose of m. i (0.060 c.c.) of the Tincture be used, for in cases of idiosyncrasy the susceptibility is demonstrated to small doses. If there are no untoward effects one may rapidly mount to the dose advised.

If there be no idiosyncrasy one feels free to give large doses, for this is one of the drugs that children bear proportionately better than adults, taking as J. Walter Carr says at four or five years as large doses as adults.

One may give doses at more frequent intervals, every four hours, if preferred, but when the full dose is attained, to the production of flushing with its attendant disagreeable manifestations, I think the fewer doses are to be preferred.

If we are treating an infant of six months, one begins with a dose of m. ss to i (0.030–0.060 c.c.) three times a day or the fluid extract m. ⅒ (0.006 c.c.), at one year double the dose, at two years begin with m. iii (0.20 c.c.) of tincture and increase a minim (0.060 c.c.) a dose every day to "flushing."

Beside the flushing one may anticipate dryness of the mouth, some hoarseness and dilated pupils.

Idiosyncrasies for the drug are shown both by the symptoms just specified occurring with a minimum dose or by a general erythema, suggesting scarlet fever, a talkative delirium and more rarely by vomiting and prostration.

If the delirium is wild it may be controlled by morphine, while prostration or collapse may be combated by caffeine, camphor and strychnine. The bladder should be emptied by catheterization, if retention occurs and in severe cases saline infusions help to encourage diuresis and elimination.

Bromides. These drugs are hardly potent enough to be of much avail unless pushed to a point of general depression, but combined with antipyrin may enhance the sedative effect of the latter. They may be used with the antipyrin in the latter part of the day and more especially when there is much insomnia. The dose for a child of two should be gr. iii (0.20 Gm) with each dose of the antipyrin used.

Some authors recommend, however, that they be used alternately a week at a time.

Opium and Its Derivatives. The efficiency of opium in lessening cough, and in inducing sleep sorely tempts the physician and the parent to an unwise usage. It must be remembered that the disease is to be long drawn out, that a certain degree of tolerance will be established and that children are highly susceptible to its toxic effects. For all these reasons it should be used sparingly and only when imperative, that is, when the other sedatives specified are without effect and danger threatens from the exhaustion induced by the paroxysms.

Of opium itself, the best preparations are Dover's powder and paregoric (Tr. opii camphorata). Of its derivatives, codeine and heroin.

Reserve their usage for the severe cases or confine the dosage to night administration.

Try first the effect of the least harmful of these preparations, **codeine.** It may be given in solution as the phosphate or in tablet form to the older children as sulphate, the dose being gr. 1/100 (0.0006 Gm) at six months, gr. 1/60 (0.001 Gm) at one year, gr. 1/40 (0.0015 Gm) at two years up to gr. 1/8 (0.008 Gm) or gr. 1/4 (0.015 Gm) in the older children.

Of the **paregoric** m. iii–iv (0.20–0.25 c.c.) at six months, m. v–x (0.30–0.60 c.c.) at one year, m. x–xx (0.60–1.30 c.c.) at two years up to ℨss (2 c.c.) at five years.

Of the **Dover's powder** gr. 1/8 (0.008 Gm) at six months, gr. ss (0.030 Gm) at one year, gr. i at two years and gr. ii (0.125 Gm) at five years.

These drugs are best administered at bedtime and in severe cases may be administered again during the night.

MEASURES RECOMMENDED BY OTHER AUTHORITY

Quinine. This drug has long been in use in pertussis. The general instructions are to administer it late in the disease and then in large doses of gr. i to gr. iss (0.060–0.10 Gm) for every year of the child's life, two to four times a day. It is hard to see what benefits can accrue so late in the disease to offset the discomforts or possible toxic effects of so large dosage.

Heroin. A derivative of morphine, is preferred by some men to codeine. The dose is gr. 1/100 (0.0006 Gm) at one year to gr. 1/24 (0.003 Gm) four to six times a day or to be used at night as codeine or opium.

Many other drugs have been recommended, the only excuse for using which lies in the fact that when the more tried measures fail, one feels justified in using any means that holds out any promise whatsoever.

Bromoform has had considerable vogue, but it is the consensus of opinion that little is to be expected from it, while toxic manifestations are readily elicited. To children old enough it may be given dropped on a lump of sugar. If not so, it is best given in emulsion, but it must be remembered that it easily settles out of the emulsion; hence, thorough shaking must precede its usage each time, and it is well to have a fresh emulsion made before the bottle is exhausted, to avoid the large dose that is almost sure to result in the bottom of the bottle from this fact. The dose is a 1/2 minim to 5 minims (0.030–0.30 c.c.) three times a day. It must be used with caution. Personally, I prefer not to use it.

Fluoform, in 2 per cent. solution in water in doses of ʒi (4 c.c.) of the solution every two hours has been recommended.

Another fluorine compound is a difluordiphenyl; it is used locally on the chest in the shape of an ointment. This is known as **antitussin.** I have had no experience with these preparations.

Specific Treatment. Specific treatment by the use of sera and vaccines awaits upon the certain identification of the etiological agent. This certain identification has not come, but the claim of Bordet and Gengou that they have isolated the bacillus responsible for the disease seems so good, that this organism, isolated from the bronchial mucus raised by the paroxysm in the earlier stages of the disease, has been utilized for the production of a vaccine.

The number of cases so treated up to the present time is so limited and the tendency with any new effort is so much towards optimism that an opinion as to its usefulness should be reserved until more data have accumulated, but as no bad results, general or local, have attended the treatment so far, I should be inclined in a severe or stubborn case to use the treatment.

The optimum dosage is not yet determined, but it would seem well to begin with 20,000,000, running it up to 40,000,000, 60,000,000, 80,000,000, and 100,000,000 at three-day intervals, giving the maximum dose until the total number was eight or ten; less, if early and decisive improvement is obtained, more if prolonged and stubborn.

Graham, in a recent series of twenty-four reported 71 per cent. of improvement.

Sill has most recently contributed an enthusiastic article to *Forchheimer's Therapeusis of Internal Diseases* on the subject of vaccine treatment and has a considerable series of successes to report.

Should his figures be confirmed the vaccine treatment would prove not merely desirable but obligatory.

His tendency was to larger doses, beginning with 50,000,000 under two years and 100,000,000 in older children and increasing. His intervals are two to three days. He uses a commercial vaccine of the Bordet-Gengou bacillus.

Other series are less encouraging.

Various sera have been tried without encouraging results.

Insomnia. Sleeplessness is so much the result of the frequency of the paroxysms that measures that relieve the latter improve the former. The doses of **bromides** advised towards the latter part of the day either in combination with the antipyrin or alone gr. iii (0.20 Gm) are helpful.

Chloral is well borne by the child and it may be administered at night in doses of gr. ii (0.12 Gm) at six months, gr. iii or gr. iv

(0.20–0.25 Gm) at one year and if not efficacious the dose may be repeated in two hours. It is somewhat irritating to the stomach; hence, it may be given by the rectum in a couple of ounces of warm milk.

Trional has also been used for the purpose, gr. ii to gr. iv (0.12–0.25 Gm) at two years to be repeated if needed.

Complications. **Vomiting** regularly accompanies the disease, but may become so persistent and severe as to constitute a complication.

The first consideration is that of the **diet** which has already been discussed under that heading.

The application of the **abdominal support,** such as the Kilmer belt, in many instances lessens the severity and frequency of the vomiting in no small measure.

When the vomiting occurs with the paroxysms, those measures which lessen the attacks of coughing will diminish the vomiting, but at times the vomiting may occur apart from the paroxysms, as an expression of gastric irritation. In these cases, small doses of **bicarbonate of soda,** gr. v (0.30 Gm) with the food may be helpful, while in the more severe cases **cocaine hydrochlorate,** in doses of gr. 1/6 (0.010 Gm) twice a day has been recommended. (Eustace Smith quoted by Ker.)

Diarrhea is to be treated by a consideration of the **diet,** an occasional dose of **calomel** in divided doses, gr. 1/10 (0.006 Gm) every ten minutes for 10 doses or gr. 1/4 (0.015 Gm) every 1/4 hour for 4 doses, followed by bismuth subnitrate, gr. xx to gr. xxx (1.30–2 Gm) every three or four hours and by occasional irrigations. The small doses of calomel act, too, as an antiemetic.

Ulcer of the Frenum. An ulcer of the frenum of the tongue occurs now and then in whooping cough. It is usually superficial but may be deep. It is due to the projection of the under surface of the tongue upon the cutting edge of the incisors.

Efforts at healing are made by boric acid mouth washes and occasionally touching the ulcer with **silver nitrate** stick.

If it resists we may call dental aid to protect the tongue against the teeth or if the process is serious sacrifice the teeth, which, of course, are first teeth.

Hemorrhages. These occur in various parts of the body, but require no treatment (or expectant or symptomatic treatment in case of cerebral hemorrhage), except nasal hemorrhages.

These at times may be sufficiently severe to require the application of adrenalin, in a spray of 1 to 10,000 or if the bleeding point can be seen, on a pledget of cotton, 1 to 1,000.

Very rarely the nares may require plugging.

Coakley advises as a hemostatic tannic acid, mixed with water to the consistency of a syrup and applied on a pledget of gauze.

Bronchopneumonia. This complication is what makes whooping cough the serious disease it is. It is responsible for the vast majority of the fatal cases, estimated by some authorities at 90 per cent. It is prone to occur after the paroxysmal stage is well established, in the second or third week.

The treatment is that of bronchopneumonia under other circumstances and will be found described under Pneumonia, Chap. IV, and under Measles, Chap. XI.

It is necessary to emphasize the importance of the open air treatment of these cases, the adoption of which has materially lowered the mortality of this dread complication.

The only contraindication is a laryngitis of severe grade.

Such treatment must be carried out with rigid regard for proper technique, which will be found described in the chapter on Pneumonia, Chap. IV.

Convulsions. Next to bronchopneumonia this is the most fatal of the complications of whooping-cough. The nervous system is in such an irritable condition that slight sources of irritation may precipitate a convulsion and, indeed, convulsions may occur in relatively mild cases; they occur in all degrees of severity, from trivial short lived spasms to prolonged and fatal attacks.

The physician is rarely at hand at the beginning of the convulsion and until he arrives great alarm is experienced by the family and for their sakes, as well as for that of the child, some instructions should be given to meet the condition. Perhaps the best measure to be pursued by the parent is the giving of a hot mustard bath or pack and because of the lesser disturbance and handling of the patient demanded by the latter procedure, the pack is to be preferred.

Into a quart of luke-warm water a tablespoonful or handful of mustard is thrown, a towel dipped in it and wrung out and wrapped about the baby. The child is then wrapped about with a blanket, an ice cap put at the head or lacking the ice-bag, cracked ice in a towel, a hot water bottle at the feet, a small fold of a towel tucked in the corner of the mouth to protect the tongue from the teeth, but with care not to obstruct the breathing and then the child kept as quiet as possible. The pack is to be continued for ten or fifteen minutes, then the child is wrapped in a dry blanket, heat kept about the body and extremities and cold at the head.

The bath is prepared by using mustard, a tablespoonful to the gallon, use a small part of the water at a tepid temperature to prepare the mustard and then add the rest of the water, raising the temperature of the bath to 100° F. (It is to be remembered that hot water kills the ferment in the mustard and no oil will be generated to effect an irritation.) The bath can later be raised three or four degrees. It is continued some ten minutes and then the child is dabbed dry, wrapped in blanket and treated as after the pack.

The physician's first effort is to promptly interrupt the convulsion and his next to prevent its recurrence.

To interrupt the convulsion nothing is better than a few whiffs of **chloroform**, given with care, not crowded down upon the face. As soon as the desired result is attained, the prevention is sought in the administration of **chloral**, a drug toward which a child has considerable tolerance and particularly when convulsed. It is better administered by the rectum to avoid its irritating effects on the stomach. The irritation to the rectum is prevented by the use of an ounce or two of warm milk as a solvent. The dose at six months is 3 or 4 grains (0.20–0.25 Gm), at one year 5 or 6 grains (0.30–0.35 Gm), and by some given in doses of gr. x (0.60 Gm). At two years 8 or 10 grains (0.50–0.60 Gm). The dosage will depend somewhat upon the severity of the attack. If there is twitching at the end of an hour the dose may be repeated.

The drug may be expected to take effect within a half hour.

Some practitioners add **bromide** to the chloral in doses of approximately twice as much bromide as chloral. If, however, after the use of the chloroform and chloral the convulsions recur, **morphine** should be used.

The drug should be used hypodermically and in sufficient dose. At six months the dose usually recommended is gr. 1/48 (0.0015 Gm), at one year gr. 1/24 (0.003 Gm), and at two years gr. 1/16 (0.004 Gm), and this dose, if not effectual may be repeated in a half hour to an hour.

Those who are imbued with the traditional fear of morphine in infancy may begin the initial dose with a slightly smaller amount, but satisfactory results will hardly follow in severe cases unless the larger doses are used.

In obstinate cases I would recommend a lumbar puncture. I have seen very satisfactory results in a few cases of continued convulsions, in other conditions follow this procedure.

Other Measures Recommended. Holt recommends **oxygen inhalations** as of value in some cases which have resisted other efforts.

Still recommends urethane to prevent recurrence of convulsions in doses of gr. i¾ (0.10 Gm) three times a day for an infant of nine months and in doses of gr. iii to gr. viii (0.2–0.50 Gm) three times a day for children six to ten years old.

Release from Quarantine. There is a great disagreement about the length of time a case may be a source of danger, ranging from six weeks to six months. It seems certain that the most contagious period is the catarrhal and early paroxysmal and a whoop may continue long beyond the infective period.

More data with reference to the persistency of the organism and its period of virulency may help to decide this important question before long.

Convalescence. Another reason for dread of this disease is its prolonged course. The average duration of the paroxysmal stage is six weeks, but many run a much longer period and especially in the winter, when pulmonary complications always threaten. The paroxysms often last for months, in many cases long after the infection has surely passed. How much this continued cough and whoop is due to a curious irritability of the laryngeal muscles in the presence of what would otherwise be a trivial catarrh of the mucous membranes of the laryngo-tracheal tract or to a mere habit it is difficult in many instances to determine. The continued administration of sedative drugs to subdue this occasional cough is pernicious.

In the young children and infants the **treatment** during convalescence resolves itself into a **dietetic** one, for the degree of malnutrition is in many cases grievous and the powers of repair much reduced.

Often a change of air is of benefit and these children seem to do particularly well at the shore, in a warm climate and even a sea voyage may be of great benefit.

Of **tonics, iron** in the shape of the bitter wine of iron, vinum ferri amarum, in doses of ʒi (4 c.c.) in water t.i.d. or Vallet's mass or Blaud's pill gr. ii to gr. v (0.20–0.30 Gm), according to age is indicated and in infants cod-liver oil, best given clear in doses of m. xv to ʒi (1–4 c.c.) three times a day. No drugs should be used if they induce gastric disorder or if there is anorexia and a coated tongue. The bowels should be attended to by the use of the milk of magnesia in doses of ʒi to iv (4–15 c.c.) or cascara, best in the form of some elixir or aromatic preparation.

Fresh air by day, the sleeping porch by night are of vital importance in clearing up the residuum of bronchial catarrh and avoiding colds; **baths** with **cool sponges** following and progressively becoming colder, exercise in the open to the point of comfortable fatigue, avoidance of wet feet or exposure are the paths to health and these measures are the more important in view of the fact that next to measles no disease is so commonly followed by tuberculosis as pertussis.

Removal of large tonsils and adenoids may hasten the disappearance of the paroxysms and the completion of convalescence.

SUMMARY

Distribution of the family.

Separate the suspects from other children. Remove infants from the same house, if possible.

Contacts should be in isolation for three weeks.

Contacts may receive a prophylactic treatment with vaccine. (See text.)

Remember modes of conveyance by spraying of coughing, sneezing, laughing and talking, for this can occur in the open air; hence, avoid environment of a case even in the open.

During an epidemic keep children from gatherings of children, parties, etc.

Room.

Light and air.

Approach to verandah or balcony, or two rooms, for change from one to the other, permitting of thorough ventilation.

Occasional formaldehyde disinfection of room.

Open air.

Milder and uncomplicated cases may be kept up and out of doors.

More severe and complicated, open air, if patient can be kept covered.

Avoid draughts, high winds and dust. If feasible, temperature of room should be from 65° F. to 70° F.

Two children should not be treated in the same room.

Clothing.

Flannel next the skin. Avoid over-loading.

Nurse.

Should not be urged to take the case unless she has had pertussis.

Avoid contact with other children.

Should never leave her patient when on duty if a young child or infant, lest it suffocate in a paroxysm or have a convulsion.

Physician.

Should wear gown.

Should wash face and hands on leaving case.

Should not go at once to another child.

If he has not had pertussis he may wear a small mask, like a chloroform mask, wet with 1–20 phenol.

Should avoid standing in front of a patient during a paroxysm.

Precautions.

Strict isolation to quarters assigned, if in the house.

Avoidance of other children if allowed out of doors.

Secretions should be received on gauze and burned.

Bed-linen, night clothes, handkerchiefs, towels, etc., boil an hour or soak over night in 1–20 phenol, then launder.

Domestic pets may carry the disease and should be excluded.

Bed.

For preparation of bed for open air, see Pneumonia, Chap. IV.

Indications for remaining in bed.

When there is fever.

When there are complications.
When there is great nervous irritability.

Bath.

Cleansing bath of soap and warm water daily, on a blanket or between blankets.

Diet.

- Older patients and mild uncomplicated cases, no change.
- When vomiting is present and gastro-intestinal symptoms are present.
  - Feed right after a paroxysm as there is then a period of quiescence and avoid feeding near an anticipated paroxysm, as it precipitates it.
- When paroxysms occur hourly or oftener.
  - Give small quantities of high calory food frequently.
  - Milk plain or modified.
  - Dilute with water half and half.
  - Use lime water 1–20 of milk.
  - Dilute half and half with barley or arrowroot water.
  - Milk gruels of barley, wheat flour, rice, arrowroot, malted or farinaceous infant foods.
  - Whey, buttermilk, koumys, animal broths thickened with cereals and farinaceous foods, custards, baked or soft, jellies with sugar, junket, soft egg, albumin water, wet toast, milk toast, softened rusks.
- Avoid dry foods, they irritate and provoke paroxysms.
- Dilute infants' milk mixtures.
- Rectal feeding.
  - Only in most severe cases. Cannot be utilized for any considerable period.

Hygiene.

- Daily baths.
- Ordinary oral hygiene.
- Sprays for nose of 2 per cent. to 4 per cent. boric acid solution or quarter to half strength Dobell's solution.

Bowels.

Use cascara in older children and milk of magnesia in the younger or other simple and mild cathartics.

Fever.

- In uncomplicated cases needs no treatment.
- Dictates remaining in bed.

Cough.

- May cause suffocation, convulsions, cerebral hemorrhage, exhaustion, frequent vomiting and malnutrition.
- Avoid excitement or emotional state.
- Avoid dust, chilling, cold beds, draughts; quiet child's alarm by assurance. Fresh air.
- Mild cases require no treatment. Drugs only upset.

More severe cases.

- Local procedures.
  - Mechanical support, including Kilmer belt. (See text.)
  - Sprays and local applications to the nose of doubtful value.
- Inhalations.
  - Medicated steam.
    - Compound tincture of benzoin or creosote, ʒi or ii (4–8 c.c.) on hot water.
    - May use pitcher, a caraffe, simple kettle, with paper cones or regular croup kettle.
  - Best under tent. (For technique, see text.)
  - May use in place of benzoin, creosote or oil of eucalyptus in same manner.
  - Chloroform.
    - When severe and threatening convulsions or asphyxia.
  - Few drops on handkerchief, sponge or towel.
- Other measures to interrupt prolonged and dangerous spasm.
  - Pull jaw down and forward as in giving an anæsthetic (Nägele).
  - Plunging hands in cold water (Smith quoted by Ker).
- Most severe form of spasm.
  - Intubation. (See Diphtheria, Chap. X.)

Drugs.

- Antipyrin.
  - At 6 months gr. i (0.06 Gm) every three or every two hours.
  - At 1 year gr. iss (0.1 Gm).
  - At 2 years gr. ii (0.15 Gm) every six to four hours (Holt). Towards night combine with bromide of soda.
  - At 6 months gr. ii (0.15 Gm).
  - At 1 year gr. iii (0.20 Gm).
  - At 2 years gr. iv (0.30 Gm).
  - Don't use it in weakly children and in pneumonia.
  - Idiosyncrasies for antipyrin. (See text.)
- Belladonna.
  - Has to be used to the physiological limit.
  - One should begin with a small dose as idiosyncrasies are not uncommon.
- Jacobi's dose.
  - Six drops of the tincture of belladonna three times a day. This should cause a feverish flush on the cheeks in half an hour and last half an hour; if it does not the dose must be increased up to 7, 8, 9, or more drops.
  - One must get the flush each time.
  - It is better to begin with smaller doses than the above, e.g.,
  - At 6 months begin with m. ss–i (0.030–0.060 c.c.).
  - At 1 year, m. i–ii (0.060–0.150 c.c.).
  - At 2 years, m. iii (0.20 c.c.).
  - Increase a minim a dose a day up to the point of inducing flushing.
  - For other signs of full dose and for idiosyncrasies, see text.

  - Bromides.
    - Best combined with antipyrin as above.
  - Opium and its derivatives.
    - Use only when exhaustion threatens and other measures fail.
    - Best used at night.
  - Codeine best.
    - Use phosphate or sulphate.
      - At 6 months, gr. 1/100 (0.0006 Gm).
      - At 1 year, gr. 1/60 (0.001 Gm).
      - At 2 years, gr. 1/40 (0.0015 Gm).
      - Older children, gr. 1/8 to gr. 1/4 (0.01–0.015 Gm)
  - Paregoric (Tr. opii camphorata).
      - At 6 months m. iii–iv (0.20–0.30 c.c.).
      - At 1 year m.v–m.x (0.30–0.60 c.c.).
      - At 2 years m. x–xv (0.60–1 c.c.).
      - At 3 years ʒss (2 c.c.).
  - Dover's powders (Pulv. opii et ipecac.).
      - At 6 months gr. 1/8 (0.008 Gm).
      - At 1 year gr. ss (0.030 Gm).
      - At 2 years gr. i (0.060 Gm).
      - At 5 years gr. ii (0.15 Gm).
- Measures recommended by other authority.
  - Quinine. (See text.)
  - Heroin. (See text.)
  - Bromoform. (See text.)
  - Fluroform. (See text.)
  - Antitussin. (See text.)
- Specific treatment.
  - Vaccines.
    - Beginning with doses of 20,000,000 to 50,000,000 in children under two years and twice the dose in older children and repeat every two to four days with increasing doses, up to 250,000,000 or more.
    - May give 8 to 10 or 12 doses.

Insomnia.

- Relieved by measures relieving paroxysms, especially bromides and antipyrin.
- Chloral at night.
  - At 6 months gr. ii (0.15 Gm).
  - At 1 year gr. iii to iv (0.20–0.30 Gm).
  - May be repeated in two hours.
  - Give by rectum in 2 ounces of warm milk.
- Trional.
  - At 2 years gr. ii to gr. iv (0.15–0.30 Gm).

Complications.

- Vomiting of severe type.
  - Diet. (See above in summary.)
  - Belt. (See above in summary.)
- When accompanying cough.

- Measures used to control cough.
- (See above in summary.)
- Unaccompanied by cough.
  - Measures to relieve gastric irritation.
    - Sodium bicarbonate gr. v (0.30 Gm) with the food.
    - Cocaine hydrochlorate, gr. 1/6 (0.010 Gm) twice a day (Eustace Smith by Ker).

Diarrhea.

- Regulation of diet.
- Calomel occasionally, gr. 1/10 (0.006 Gm) every ten minutes for ten doses, or gr. 1/4 (0.015 Gm) every quarter hour for four doses, followed by
  - Bismuth subnitrate gr. xx to gr. xxx (1.30–2 Gm) every three or four hours.
- Occasional irrigations.

Ulcer of the frenum.

- Use boric acid (2 per cent. to 4 per cent. solution) as a mouth wash.
- Silver nitrate, touch occasionally with the stick.
- Dental assistance to protect tongue.
  - If severe may extract the incisors responsible, if they are of the first set.

Nose bleed (epistaxis).

- Spray with adrenalin (1–10,000) or apply adrenalin (1–1,000) on cotton to bleeding point. If severe, plug nares.
- Tannic acid mixed to the consistency of a syrup applied on gauze (Coakley).

Bronchopneumonia.

- (See pneumonia, Chap. IV.)
- Open air.
  - (For contraindications, see Pneumonia, Chap. IV); also severe laryngitis.

Convulsions.

- Parent or nurse may initiate treatment with hot mustard bath or pack.
- (For technique, see text.)
- To interrupt convulsion,
  - Chloroform, give a few whiffs.
- When the convulsion is interrupted,
  - Prevent recurrence.
    - Chloral.
      - At 6 months gr. iii to gr. iv (0.20–0.30 Gm).
      - At 1 year gr. v to gr. vi or even gr. x (0.30–0.40–0.60 Gm).
      - At 2 years gr. viii to gr. x (0.50–0.60 Gm).
      - Give by the rectum in 1 or 2 ounces (30–60 c.c.) of warm milk. If there is twitching at the end of an hour repeat the dose.
      - Bromides may be added to the chloral in doses of gr. ii (0.15

Gm) of the bromides to gr. i (0.060 Gm) of the chloral.
- If the convulsions recur in spite of this, use
- Morphine.
  - At 6 months gr. $\frac{1}{48}$ (0.00125 Gm).
  - At 1 year gr. $\frac{1}{24}$ (0.0025 Gm).
  - At 2 years gr. $\frac{1}{16}$ (0.004 Gm).
    - Give hypodermically.
  - If convulsions or twitching persist, repeat dose in one-half to one hour.
- In obstinate cases.
  - Try lumbar puncture.
  - (For technique, see Cerebro-spinal Meningitis, Chapter XVII.)
- Other measures recommended.
  - Oxygen inhalations (Holt).
  - Urethane (Still). (See text.)

Release from quarantine.

- When paroxysms cease unless unduly prolonged. (See text.)

Convalescence.

- Diet, especially, in malnutrition of infants and young children important.

Change of climate.

- Especially to sea-shore.
- Warm climate.

Tonics.

- Iron.
  - Bitter wine of iron (Vinum ferri amarum) ʒi–ii (4–8 c.c.) three times a day.
  - Vallet's mass (Massa ferri carbonatis) gr. i–iii (0.060–0.20 Gm) three times a day, or
  - Blaud's pill (Pil. ferri carb.) same dose.
- Cod liver oil m. xv–ʒi (1–4 c.c.) three times a day.
- Keep bowels in order.
- Fresh air by day.
- Sleeping-porch at night.
- Baths with cold sponge.
- Exercise in the open air.
- Avoidance of wet feet.
- Watch constantly for any signs of tuberculosis.

CHAPTER XV

MUMPS

(PAROTITIS)

THIS disease of uncertain etiology affects characteristically, but not exclusively, the parotid glands. It is rare in infancy, finds its maximum incidence in the second and third lustra, affects many young adults, but is again rare in later life.

It is very rarely fatal, but entails much discomfort and in its complications sometimes serious results.

There is good reason to believe that the organism isolated and described by Laveran and Catrin, a diplococcus, is the causative agent of the disease.

Distribution of the Family. I am a firm believer in the prevention in every individual of any kind of infection where possible; so, while many look upon mumps as of slight importance, if not as an amusing incident, such serious consequences can, to be sure rarely, ensue that I advise isolation of the patient or removal of the other children and young adults to other premises.

The period of incubation is from twelve to twenty-six days; hence, these contacts should not expose susceptible individuals until the expiration of twenty-six days.

I am aware that only rarely will such a recommendation be followed by the wage earner and that much protest will be voiced in cases of the school children, but, at least, in the case of the latter, they should not be allowed to go to school longer than ten days after exposure, which period trespasses close on the appearance of prodromal symptoms if they are infected and during this period of invasion they are highly contagious.

These contacts should not return to the environment of the patient until the quarantine has been raised.

Room. A well lighted and well ventilated room as free from furnishings as possible should be chosen and a bed, preferably of the hospital type.

A patient who has any fever or other evidence of constitutional reaction to his infection should be confined to bed. Mild cases in children in whom neither the one nor the other obtains may be allowed up, but confined to the room. To adults, the high incidence (about 30 per cent.) of orchitis as a complication, its distressing symptoms and the possibility of atrophy should be explained with the statement that remaining in bed until the parotid swelling has subsided plus a margin of safety, in all some ten days, is believed to lessen very materially the probability of this complication.

The infection comes from the buccal and nasal secretions and these should be destroyed.

Infection through the third person is very rare, because the infecting organism is very short lived, but the physician should wash his hands thoroughly on leaving the patient and avoid an immediate call on another susceptible individual. The nurse should take similar precautions in her absence from the sick room.

Baths. A cleansing bath with soap and water should be given every day.

Diet. The difficulty of eating makes a fluid diet or a semi-solid diet a necessity. Milk and milk preparations, cereals, milk broths, meat soups, plain or thickened with farinaceous foods, or with cracker soaked in them, custard, soft eggs, soft toast and similar substances may be used, but the quantity should be such as to satisfy the patient's appetite. If there be no fever and the patient's condition will permit the use of his jaws, a more solid food, meat, fish and vegetables may be used.

Water or drinks made of fruit juices may be allowed and in febrile cases urged.

Acid food or drinks often cause a sharp pain in the jaws and has been looked on by many as characteristic, but this does not always occur and the giving or withholding of such articles depends purely on the absence or presence of pain when taking them.

Care of the Patient. Since the infectious material is resident in the secretions of the nose and mouth and since a mixed infection of the parotid gland leading on to suppuration may occur and presumably by way of Steno's duct, the hygiene of the mouth becomes of importance.

One may use **boric acid** solution 2 per cent. to 4 per cent. as a mouth wash or a **Dobell's** solution, diluted ½ to ¾. These same solutions may be used in the nose in a spray or applied with a swab on an applicator or wooden tooth-pick.

Bowels. At the beginning of the treatment the bowels should be effectually moved by **calomel** or **salts**, or both, as gr. ¼ (0.015 Gm) calomel every fifteen minutes until gr. iss (0.10 Gm) are taken, followed in two hours by ℥ss (15 Gm) of Epsom, Rochelle or Glauber's salts.

During the illness the bowels may be moved by **mild saline**, like a Seidlitz powder, citrate of magnesia or Hunyadi water or its equivalent in one of the many aperients on the market.

Fever. Only rarely is the fever of any moment. Its discomforts are to be met by cool sponging. In the early stages, if accompanied by pains or aches **acetanilid**, gr. iss (0.10 Gm) or phenacetin gr. iii (0.20 Gm) can be given at hourly or two hour intervals.

Treatment of the Parotitis. In the majority of cases no treatment is required and no discomfort is experienced beyond a stiffness in the muscles of the jaw. It is altogether better not to interfere at all in such cases, as is often done merely because there is a swelling and either the doctor or the patient feels that something ought to be done.

The swelling lasts a week to ten days, but the second parotid may be affected so late as to drag the period out.

When there is pain and marked discomfort in the glands efforts at relief may be made first by topical application, of heat, cold or drugs.

LOCAL TREATMENT

Heat. In milder cases heat is afforded by the patient himself by the application of a dry dressing, as of absorbent cotton or of non-absorbent cotton, covering the affected part liberally and held in place by a bandage.

Dry heat can also be applied by the use of the hot water bottle or a bag, the size of which is adapted to the swelling, filled with fine scouring sand or salt and heated in the oven.

Hot fomentations are often efficacious. Two or three layers of thick flannel are laid in a towel and boiling water poured upon them. The water is wrung out of them by twisting them in the towel by turning the ends of the towel in opposite directions.

The degree of heat should first be tested, a flirt in the air made to throw off an excess of steam or hot vapor, the edges turned under to prevent any drip of hot water and a dry flannel placed over them. They should be replaced every few minutes before they get cool and this kept up for fifteen to twenty minutes at a time. When taken off the glands should be covered with dry cotton. This may be repeated as often as it affords comfort.

Cold. Some patients find more relief from cold than from heat. Cold may be applied in an ice-bag. The circular ice-bag is the best. The pieces should be about the size of the end of one's fingers, only enough water put in to cover the ice and then the air pressed out and the cover screwed on.

This makes the bag apply itself closely to the part, which it will not do if it contains air. Under the bag should be a layer of flannel, between it and the face. Instead of the ice-bag an ice poultice may be used.

Ice Poultice. "Cut two pieces of oiled muslin the required shape and size, place them together and turn over the edges about an eighth of an inch all round. Bind with adhesive plaster, leaving unbound a small section at the top till the ice has been put in. Fasten the corners securely, strengthening then with extra pieces of adhesive plaster. Mix the ice after breaking it into pieces the size of a walnut, with one-third as much flaxseed or bran, which will absorb the water as the ice melts, and with a small amount of salt, which will intensify the cold.

"Cover the poultice with gauze before applying, and hold it in place either with a binder or a four-tailed bandage, as the position requires." Quoted from *Practical Nursing* by Maxwell and Pope. Salt should be used cautiously.

Drugs. It is questionable whether any of the ointments and liniments applied do actual good. Among those which have been recommended, I will mention **camphorated oil** (Linimentum camphoræ), **Belladonna ointment** of the pharmacopeia, **Guiacol,** 1 in 20 of vaseline and lanolin equal parts, and **ichthyol** ointment 10 per cent. to 25 per cent.

Now and then a gland goes on to suppuration. In this case it should be incised.

While the seat of the infection is peculiarly the parotid glands, other glands may at times be affected, such as the submaxillary, the sublingual, the testicle, the ovary, the mammary glands, the pancreas and still more rarely the lachrymal and thyroid glands. Of course, the appreciation of their involvement by this specific infection comes only when the parotid swelling tells the tale or in the presence of an epidemic, when, even in the absence of a parotid swelling the significance of the glandular swellings is understood.

The treatment of the submaxillary and sublingual glands is the same as that of the parotid. When the testicle is involved one may speak of

Complications. Orchitis. This complication is very rare in boys before puberty, but after that period its frequency is given by some authorities as high as 33 per cent. With the involvement of the testis there is usually an exacerbation or recrudescence of the constitutional symptoms. While in some cases the discomfort is trivial, in many the pain is severe.

Ker calls attention to the fact that accompanying the orchitis there may be a slight urethral discharge. Even in the presence of the parotitis this discharge may be misunderstood as gonorrheal or on the other hand an actual gonorrheal discharge might be assumed to be a part of the orchitic involvement. A smear for the detection of the gonococcus of Neiser should be taken.

Remaining in bed during even a trivial attack of mumps lessens the likelihood of an orchitis very materially. If the patient is up and about, he must, of course, be made to go to bed.

A proper **suspensory,** to support the drag of the inflamed organ must be applied as the first and most essential measure and, indeed, in the milder cases little else is required.

A ready contrivance for affording support is a pillow stuffed between the thighs well up against the perineum; or the thighs may be brought together and a sheet of adhesive plaster 3 or 4 inches wide spread across the thighs on which the scrotum may rest. The disadvantage of these methods is that they interfere with a freedom of motion in the bed. A T bandage, one arm going about the waist and the other between the thighs, to support the scrotum, split just beyond the point of support, each half to be attached above to the part around the waist on either side or, if accessible, one of the many forms of support on the market.

A **dry poultice** may be used, which consists of an abundance of cotton about the scrotum, which retains the heat of the body.

A time-honored application is **hot lead and opium lotion** on gauze or absorbent cotton. (Liquor Plumbi Subacetatis cum Opii. Lead acetate, gr. cxx. Tr. of opium, ℨiv. Water enough to make 1 pint. Shake before using.)

The **bowels** must be kept freely open with salines during the run of **orchitis.**

The condition is likely to last from three to seven days and resolve without further trouble. The danger lies in the fact that in rare cases atrophy of the testis occurs. In the females either the ovaries or the mammary glands may be affected. There is tenderness over the site of the ovaries but the organs are rarely enlarged. **Hot applications** over the abdomen or over the mammary glands, using the measures advised for the parotid glands, may be used.

Vulvitis, too, is an unusual manifestation in the female. It is to be treated by local applications of boric acid solution, Sitz baths and hot compresses.

Pancreatitis. The vomiting, sometimes severe, the pain and tenderness in the epigastrium and left hypochondrium, coming on sometimes late in convalescence, might be readily attributed to a gastric disturbance, if one did not have in mind the possible involvement of the pancreas.

The treatment consists in the application of **heat** or **cold** over the site of pain and tenderness and a **limitation** of **diet** and **especially of fat,** both to afford the gland a relief from excitation of food taken and the dyspeptic disturbances that might ensue from inefficiency of the pancreatic ferments. The trouble is short-lived and the diminution in food will have no significance.

Nephritis, arthritis, meningismus, erythema, deafness have all been mentioned in the literature as having complicated this disease, but they are of extreme rarity and are to be treated, when they occur, as under other circumstances.

I have seen meningismus simulating tuberculous meningitis as the first expression of the attack. One wonders if the pituitary or pineal gland is involved to account for this.

No other treatment of the condition is needed, except bromides for nervousness, trional for sleeplessness, small doses of phenacetin for pain and in the very severe cases small doses of morphine.

Release from Quarantine. Isolation should continue about ten days after the swelling has ceased, but in prolonged cases it may be cut down to a week after the disappearance of the local trouble.

Convalescence. Is usually rapid and needs little else than fresh air and good food. If a **tonic** is desirable, one may use **iron,** the bitter wine in children in doses of ʒi (4 c.c.) three times a day and the Blaud's pill in the older cases in doses of gr. iii (0.20 Gm) to gr. v (0.30 Gm) three times a day.

Disinfection. The infective material is easily destroyed on exposure to light and air and many men think it unnecessary to do more than clean and ventilate the sick room.

If, however, one wishes to take extreme precautions it may be disinfected and the clothes treated as described under Scarlet Fever. (See Chap. IX.)

SUMMARY

Distribution of the family.

Contacts should not expose susceptible individuals until incubation period of three to four weeks has passed.

Patient.

Should be confined to room.
If there is fever or complications, to the bed.
Remaining in bed lessens the incidence of orchitis.

Room.

Good light and ventilation.

Physician.

Should wash his hands carefully on leaving patient and not go directly to a susceptible person.

Nurse.

Should take similar precautions.

Baths.

Daily cleansing bath of soap and water.

Diet.

Fluid or semi-solid on account of difficulty of eating.
(For suitable articles, see text.)
Acid foods or drinks often cause sharp pain in jaws.

Care of mouth.

Remember the danger of mixed infection of the parotid and its suppuration.
Boric acid solution 2 per cent. to 4 per cent.
Dobell's solution half to quarter strength.

Nose.

- Use sprays or cotton swabs on wooden toothpicks wet with same solutions.

Bowels.

- At the beginning use calomel or salts or both.
- Calomel gr. ¼ (0.015 Gm) every fifteen minutes until six doses are taken and follow in two hours by Rochelle or Epsom salts ℥ss (15 Gm).
- During illness use milder salines, such as citrate or magnesia, Seidlitz powder, Hunyadi or similar water.

Fever.

- Rarely marked.
- Cool sponges.
- If accompanied by pains and aches,
- Acetanilid gr. iss (0.10 Gm) or phenacetin gr. iii (0.20 Gm) every three hours or until relieved.

Treatment of the Parotitis.

- Often no treatment indicated.
- Pain and discomfort.
  - Topical treatment.
    - Heat.
      - Hot water bag.
      - Bags of hot salt or scouring sand of suitable shape.
    - Dry poultice.
      - Thick applications of absorbent or non-absorbent cotton, held in place by a bandage.
    - Hot fomentations.
      - (For technique, see text.)
    - Cold.
      - Ice bag.
        - (For technique of application, see text.)
    - Ice poultice.
      - (For technique, see text.)
- Drugs.
  - Ointments and liniments of doubtful value.
  - Camphorated oil (Linimentum camphoræ).
  - Belladonna ointment official, or
    - Guaiacol, 1 part.
    - Vaseline, 10 parts.
    - Lanolin, 10 parts.
  - M.
    - Ichthyol ointment (in vaseline) 10 per cent. to 25 per cent.
- Suppurating glands.
  - Should be incised.

Complications.

- Orchitis.
  - Suspension.
    - Pillow stuffed between thighs.

  - Sheet of adhesive plaster across the thighs, on which scrotum may rest.
  - A T bandage.
- Dry poultice.
  - Abundance of non-absorbent cotton.
  - Hot lead and opium lotion on gauze or absorbent cotton.
    - Lead acetate, gr. cxx (8 Gm).
    - Tincture of opium, ʒii (8 c.c.).
    - Water to make 1 pint (500 c.c.).
- Keep bowels open.
- Ovaries.
  - Hot applications to abdomen.
- Mammary glands.
  - Much such measures as in orchitis.
- Vulvitis.
  - Boric acid solutions 2 per cent. to 4 per cent.
  - Hot compresses.
  - Hot sitz baths.
- Pancreatitis.
  - Limit fat in diet.
  - Apply heat or cold over site of pain.
- Nervous system.
  - Bromides gr. x to gr. xv (0.60–1 Gm) in water three times a day.
    - gr. xv. to gr. xxx (1–2 Gm) at night.
- Sleeplessness.
  - Bromides gr. xv to gr. xxx (1–2 Gm) in water at night.
  - Trional gr. x to gr. xv (0.60–1 Gm).
- Pain.
- Phenacetin gr. iii–v (0.20–0.30 Gm).
- Morphine gr. ⅒ to gr. ⅛ (0.006–0.008 Gm).

Release from quarantine.

- Ten days after disappearance of local trouble.

Convalescence.

- Fresh air.
- Good food.
- Iron if tonic is needed.

Disinfection.

- Clean and ventilate room.

CHAPTER XVI

GLANDULAR FEVER

This is essentially a disease of childhood, occurring only occasionally in adult life, and is characterized by glandular swelling especially of the neck.

It begins as a rule on the left side.

Axillary and inguinal glands may be involved and possibly some of the deeper sets.

Liver and spleen have been found enlarged in some cases.

The adenitis is a result of an acute infection but the nature of the infecting agent is not known.

Isolation. The disease is undoubtedly contagious, hence, the child affected should be kept from contact with the other children.

Suspects and children who have been exposed should be kept from susceptible individuals for a week or ten days, for the incubation period while still undetermined is believed to be about a week.

Room and Bed. If the patient be confined to the bed, and that is only when fever or complications are present, they should be selected as in other contagious diseases.

Diet. If there is anorexia or vomiting the food is not pressed until these symptoms have subsided, then the ordinary diet for febrile cases is allowed. See Chap. II.

Water is given freely.

Bowels. **Calomel, salts** or **castor oil** should be given at first. If there is much nausea or vomiting calomel in divided doses may be used, e.g., gr. ⅒ (0.006 Gm) every ten minutes for ten doses, followed in two hours by milk of magnesia ℥ss to i (15–30 c.c.) or Liq. magnesii citratis ℥iv to viii (120–240 c.c.) or if there is no nausea the salts alone or castor oil in doses of ʒii to ℥ss (8–15 Gm or c.c.) according to age may be given.

Throughout this disease the bowels should have attention, an enema or mild saline like Liq. magnesii citratis being given every other day.

Care of Mouth and Nose. Mild alkaline sprays and mouthwashes such as quarter strength Dobell's solution or 2 per cent. boric acid solution, or warm physiological salt solution may be used.

There is likely to be a mild grade inflammation of the tonsils or pharynx, but bearing no relation to the adenitis.

That the glands sometimes suppurate and that otitis, parotitis, nephritis has been known to occur, accentuates the necessity for care of the mouth, the possible source of such complications.

Toxæmia. At the onset the usual malaise, headaches, pains and fever of an infection may occur. If these are marked small doses of **phenacetin** gr. i to gr. ii (0.060–0.12 Gm) every two to three hours or aspirin gr. ii to gr. v (0.12–0.30 Gm) or salicin gr. iii to gr. x (0.20–0.65 Gm) at the same intervals may be used to relieve discomfort.

Fever. The temperature is not high as a rule but may reach 104° F. or 105° F.

Sponging with cool water may make the patient more comfortable.

Adenitis. The large tender glands are the "hall-marks" of the disease. They become obvious after twenty-four to forty-eight hours and increase to the size of pecan nuts, remaining discreet.

As a rule they begin high up under the sterno-cleido mastoid of the left side spreading later to the right side.

They cause the patient to hold the neck stiff and at times to experience some pain on swallowing; moreover, these glands are very sensitive to the touch.

All the glands of the neck are likely to become involved, even "a fine network of glands about 1 c.c. in diameter, like the spots placed at the intersection of the strands of a large mesh veil, covers the entire lateral and posterior aspects of the neck," as Haas picturesquely put it.

Beside the superficial glands, cervical, axillary, inguinal, epitrochlear, the mesenteric causing pain in the region of umbilicus, bronchial and mediastinal perhaps causing the croupy cough, may be involved.

Relief of pain and discomfort may be sought in the measures applicable to adenitis from other causes, namely, **heat**, in the shape of hot fomentations (see Scarlet Fever, Chap. IX) or poultices, or hot-water bag or **cold** in the shape of the ice-bag or cold compresses. (See Scarlet Fever, Chap. IX.)

Ichthyol is a favorite application in 25 per cent. to 50 per cent. in vaseline.

Very rarely a gland may suppurate, when it is to be treated surgically by **incision** and evacuation of pus.

For glands which are slow in receding Haas recommends Fowler's solution (Liq. potassi arsenitis) m. ii to x (0.12–0.65 Gm) in water three times a day.

Complications. Beside the occurrence of suppuration in an affected gland, otitis media and nephritis are the only serious complications fortunately rare. They are treated as under circumstances. (For nephritis, see Scarlet Fever, Chap. IX; for otitis, see Scarlet Fever, Chap. IX.)

The course is usually mild and although the glands do not resolve for two to four weeks the malaise and fever disappear after a few days, though slight recrudescences may occur with involvements of other glands or recrudescences of the process in the same glands or set of glands with febrile manifestation may be repeated several times. The case impresses one at times as a streptococcus invasion and certain bacterial findings in the throat and suppurating glands strengthen the impression. Again the condition is at times difficult to differentiate from mild scarlet fever for erythematous rashes in glandular fever are occasional happenings. The late glandular relapses and nephritis increase the perplexity of the diagnostician.

Convalescence. Severe secondary anæmia may occur and in severe cases may be quite striking. Iron may be administered for this.

In the younger children the bitter wine of iron (Vinum ferri amarum) ʒi to ʒii (4–8 c.c.) three times a day, or in older children Vallet's mass (Massa ferri carb.) gr. ii to gr. v (0.12–0.30 Gm) three times a day, or Blaud's pill (Pil. ferri carb.) in same doses.

As a general tonic small doses of the tincture of nux vomica, m. ii to m. x (0.12–0.65 c.c.) or strychnine sulphate gr. $\frac{1}{150}$ to gr. $\frac{1}{60}$ (0.00045–0.001 Gm) three times a day according to age.

Fresh air and good food are the best tonics.

Prognosis is good. The only cases to be dreaded are those complicated by Nephritis.

Prophylaxis. We know so little about the mode of conveyance of this disease and indeed of its true nature that we are unable to effect efficient prophylactic measures beyond isolation of the sick child in the family.

SUMMARY

Treatment.

Isolation.
  The child should be kept from contact with other children.
  Suspects and children who have been exposed should be kept from susceptible individuals, a week or ten days.

Room.

Light and airy.

Diet.

Do not force feeding during period of anorexia.
Later follow rules in Chap. II.
Give water freely.

Bowels.

Calomel gr. $\frac{1}{10}$ (0.006 Gm) every ten minutes for ten doses, followed by
Milk of magnesia ℥ss–i (15–30 c.c.) or
Liquor magnesii citratis ℥iv–viii (120–240 c.c.) or if there is no nausea

- Salts alone, or
- Castor oil ʒii–iv (8–15 c.c.).
- Enema or mild saline every other day.

Mouth and throat.

- Washes and sprays of
- Two per cent. to 4 per cent. boric acid solution.
- Dobell's solution, quarter strength.
- Warm physiological salt solution (ʒi of common salt to 1 pint, 4 Gm to 500 c.c.).

Toxæmia.

- Pains and aches of sthenic period.
  - Phenacetin gr. i–gr. ii (0.060–0.12 Gm) every two or three hours or
  - Aspirin gr. ii to gr. v (0.12–0.30 Gm) at same intervals or
  - Salicin gr. iii to gr. x (0.20–0.65 Gm).

Fever.

- Sponging with cold water.

Adenitis.

- Heat.
  - Fomentations.
  - Poultices.
  - Hot-water bottle.
- Cold.
  - Ice-bag.
  - Cold compress.

}(See Scarlet Fever, Chap. IX.)

- Ichthyol 25 per cent. to 50 per cent. ointment over the affected glands.

Surgery.

- Incision of suppurating glands.

Delayed resolution.

- Fowler's solution (Liq. potassi arsenitis) m. ii to m. x (0.12–0.65 Gm) three times a day.

Complications.

- Rare.
- Otitis.
- Nephritis.

}(See Scarlet Fever, Chap. IX.)

Convalescence.

- Anæmia.
  - Iron.
    - Vinum ferri amarum (Bitter wine of iron) ʒi to ʒii (4–8 c.c.) three times a day for young children.
    - Vallet's mass (Massa ferri carbonatis) gr. ii to gr. v (0.12–0.30 Gm) or
    - Pil. ferri carbonatis (Blaud's) same doses.

Tr. nucis vomicæ m. ii to m. x (0.12–0.65 c.c.) three times a day or

Strychnine sulphate gr. $\frac{1}{150}$ to gr. $\frac{1}{60}$ (0.00045–0.001 Gm) three times a day.

Fresh air.

Good food.

Prophylaxis.

Isolation of sick child.

CHAPTER XVII

CEREBRO-SPINAL MENINGITIS

A general infection, due to a definite organism, the diplococcus of Weichselbaum (diplococcus intracellularis meningitidis), the characteristic symptomatology of which is referred to the site of its greatest local activity, the meninges of the brain and spinal cord.

It is one of the few diseases for which a specific treatment has been achieved and for this reason an etiological diagnosis is important, that is, the recognition of the causal organism in the cerebrospinal fluid.

Distribution of the Family. One has to consider the possibility of infection of other members of the family and the danger which other members of the family may be, in the capacity of carriers, to those outside.

So rarely did fresh cases break out in the wards of hospitals admitting these cases and so rarely did physician or nurse acquire the disease from the patient, that for a long time it was assumed that the disease was not contagious and even to-day such facts as these and that in large epidemics, in the vast majority of instances, only one member of a family is affected is hard to understand, but more careful study and experimentation has demonstrated the contagiousness of the disease and the important rôle of the carrier. It is because of the high mortality of the disease and the dread possibilities even in case of survival, that Public Health authorities have included it among the contagious and reportable diseases and it becomes incumbent upon us to pursue every means to prevent our patient from being the source of yet another case.

The insistence on that isolation that has become habitual in the case of scarlet fever has not yet been voiced by writers on the subject, but it seems to me such isolation is as imperative in the case of the one as the other, for the high mortality and the wretched sequences of the one balance the high incidence of the other.

The patient, then, should be isolated with nurse or attendant.

Other children should be removed, if possible, and to quarters where they shall not come in contact with children, for though they may not develop the disease they may still be carriers of the infection capable of infecting others.

How long these "contacts" should be isolated is a difficult matter to decide. The incubation period has not been very well determined, but some of the observations suggest that in some cases, at least, it may last a month, though usually it is a much shorter period. One might take three to four weeks as a fair period with our present scant information.

If laboratory facilities are at hand these children should have their nasal secretions examined to determine whether or no they harbor the diplococcus in the nasal passages.

If the children can not be removed, communication direct or indirect with the patient must be carefully avoided.

Adults, though still susceptible, are far less so than children, but, with the exception of those members of the family whose presence in the sick room is necessary to the patients, no contact with the patient should be allowed.

Adults in the family must remember that infection of fresh cases has occurred curiously frequently through a third person; hence, they should avoid contact with children. If the adult comes in contact with children in the course of their daily duty, they should remove from the environment of the patient and observe a period of isolation, as in the case of the children cited above.

In all cases where possible these "contacts" should have their nasal secretions examined to determine whether they are "carriers" or no, and, if so, should avoid children at least as long as the epidemic lasts.

The number of people who in contact with the sick become "carriers" is surprisingly large, Elser and Huntoon, during an epidemic, determined that at least 70 per cent. were in this class.

Apart from the epidemic the "carriers" were rare, but occasionally a person becomes a permanent "carrier" and can convey the disease.

That so few of the persons harboring the organisms in this manner become themselves the victim of the disease would bespeak the probability of some other factor in the determination of the infection and with our present views of infection, we seek it in the lowering of the individual's resistance. For this reason, it becomes doubly important to avoid during an epidemic minor infections, such as rhinitis, tonsilitis, etc., at other times trivial, lest it afford the opportunity for the diplococcus of Weichselbaum to gain entrance into the blood.

"Contacts" should use a mild spray for the throat and nose, such as 2 per cent. boric acid or Dobell's solution, quarter strength, or one of the mild equivalents on the market. Under no circumstances should strong astringents or strong bactericidal solutions be used, lest the irritation set up in the mucous membrane lessen the resistance of the structures to the invasion of the infecting organism.

Nurse. The nurse from her intimate contact with the patient is very likely to become a carrier. For this reason she should avoid coming into contact with children during her hours off duty and remember that coughing, sneezing and kissing are means by which the organism may readily be conveyed to another.

She should clean her hands and face with soap and water and alcohol or bichloride 1 to 1,000 and spray her nose and throat before going out. As a precautionary measure she should use one of the mild sprays advised above from time to time while on duty.

Physician. The physician has always to think about the possibility of carrying the disease; but, fortunately, it is rarely that he can be shown to have done so. The organism is readily killed by drying and exposure to sunlight and the physician's contact with the patient is brief. He should, however, carefully cleanse his face and hands with soap and water and alcohol or 1 to 1,000 bichloride and spray his throat and nose before leaving the case for another call and should make his stay with the patient as brief as is compatible with the performance of his duties. He should, moreover, spend some period in the open air before another visit is made and endeavor not to make his next call upon a child.

Room. A large well ventilated room, free of furnishings, with bare floors or floors covered with some cheap material which may be destroyed after the patient has been removed, such as carpet lining covered with unbleached muslin, should be chosen. A verandah leading from the room and a bath room immediately contiguous are advantages. Light and air are potent allies in destroying the infection.

If the light hurts the eyes, suitable screens may be arranged to protect the patient.

Avoidance of noise, jars, irritations of all kinds are to be observed on account of the marked hypersensitiveness of the patient.

Precautions in the Sick-Room. Since the infective material is known to reside in the nasal and oral secretions, all these should be received on rags or muslin that may be destroyed or into vessels in which they may be disinfected with carbolic 1 in 20 or bichloride of mercury 1 in 500.

The thermometer should be left in the sick room and kept in carbolic 2 per cent. to 5 per cent. or in formalin.

Eating utensils should be boiled, but if sent out of the sick room for that purpose should be previously soaked in 1 to 20 carbolic acid for twenty minutes to a half hour. Urinals, bed-pans, etc., should be disinfected with 1 to 20 carbolic (phenol) or 1 to 500 bichloride, while clothes should be soaked over night in 1 to 50 to 1 to 20 phenol and then boiled a half hour to an hour before being put in the family wash.

Bed. The bed is to be prepared in the usual way. It is doubly imperative to avoid wrinkles, crumbs, dampness of the sheets from secretions, because of the tendency to form bed-sores in this condition. If the emaciation is marked, the nutrition of the skin badly impaired or any hint of a bed-sore observed, it is well to have a water-bed or air mattress.

The extreme sensitiveness of the patient to cold makes a demand on more clothing than in other febrile conditions.

The Patient. Much depends on the skill, fidelity and patience of the nurse in attendance. The demands are often continuous and insistent, the pains and discomforts sacrifice rest and sleep and so strength. For this reason and because of the long course many of the cases take, all should be done to economize the strength and health of the nurse, in the choice of a room, the nearness of the bath room, the quiet and seclusion of her own rest hours. Two nurses should be on the case, one for night and the other for day.

The patient should wear a night-gown of light flannel or if this is irritating, cotton. It should be open all the way down in front, to make the necessary examinations possible with the least disturbance to the patient.

Diet. During the early hours or days of the infection when the fever is high and the evidences of intoxication acute, the feeding is not to be urged against the anorexia, but as the disease is peculiarly associated with emaciation and is likely to be long drawn out, the feeding after the first few days, even in the presence of fever or stupor is to be increased, given at regular two and three hour intervals.

Often at a later stage the appetite is keen, if not ravenous, and it should be indulged abundantly.

At first the food should be liquid, milk or one of the milk preparations, such as buttermilk, koumys or if there is any gastric disturbance, skim milk, whey or peptonized milk.

Cereal gruels or well cooked cereals and farinaceous foods, such as arrowroot, barley, rice, cornstarch, farina, imperial granum, cornmeal, oatmeal, if it occasions no gas formation, jellies of barley flour, tapioca, sago, milk toast, veal, mutton, chicken or beef broths, may be used. These may be thickened with barley or other flour. Later, ice cream, eggs, custard, potatoes, oysters, scraped meat, puréed peas, small string beans or spinach and asparagus tips.

In infancy the modification of the milk is to be changed to a somewhat greater dilution.

In stupor or in case the patient can not swallow, the feeding must be by gavage or nasal feeding; it is well to change occasionally from one to the other. As a rule in the older patients the oral route is preferable, while in children the nasal is the better.

Drinks. Water, fruit juices in water, carrying sugar, not merely to sweeten but to add materially to the food ingested, are administered.

The feeding should be at intervals of two to three hours and as the case becomes subacute, some definite idea of the actual amounts of heat units ingested and energy needs of the case must be kept in mind. (See Chap. II.)

Skin. A cleansing bath of warm water and soap should be given each day. Bed sores are prone to occur. The emaciation accentuating the bony prominences makes it imperative to relieve the pressure upon these points by frequent **change of position,** mechanical devices such as rings and cushions, by keeping these parts scrupulously clean and dry and by frequent rubbing to keep the circulation active in the skin and by the use of **alcohol rubs** and **talcum powder,** by **avoiding wrinkles** in the sheets, crumbs in the bed and by most gentle handling. If sores are imminent the air mattress or water bed should be used and increasing care given the threatened parts.

Mouth and Nose. In the care of the mouth and nose in this disease two things are to be kept in mind; first, the comfort and welfare of the patient; second, the danger his secretions entail to others.

The **mouth** should be cleansed by having the patient rinse his mouth with plain water, followed by 2 per cent. to 4 per cent. **boric acid** solution or **Dobell's solution,** half to quarter strength, used as a mouth wash or spray. After eating, the nurse should see that all dead spaces in the mouth and interstices of the teeth are freed from food particles by the use of small cotton swabs on wooden tooth picks or other simple applicator, wet with the same solution.

If there is **sordes** on lips and teeth or the tongue is heavily coated, half strength official hydrogen peroxide may be applied to soften the deposit and in case of the tongue the edge of a whalebone or equivalent instrument may be used as a scraper, then followed by the solutions mentioned. For a dry mouth equal parts of 2 per cent. boric acid solution and albolene with a little lemon juice is excellent.

The nose may be sprayed by the same solutions.

All secretions should be destroyed, preferably by burning and danger in handling these secretions should be kept in mind by the nurse, who should carefully wash her hands and have recourse to an antiseptic, such as alcohol or 1 to 1,000 bichloride after the ministrations.

Eyes. There is likely to be a conjunctivitis of mild or moderate grade. It is believed that these secretions, too, are infectious and for that reason they should be destroyed with the same care as in the case of nasal secretions. For the eyes nothing is better than mild boric acid washes of 2 per cent. strength.

Bowels. The bowels should be freely opened at the beginning of the illness and attention given them throughout the course.

For an initial catharsis, calomel in doses of gr. ¼ (0.015 Gm) every quarter hour for four or five doses, followed in two or three hours by milk of magnesia in dose of ℥ss (15 c.c.) is suitable and is especially good in cases of vomiting, in which the divided doses of calomel is credited with an antiemetic action and the milk of magnesia acts as a gastric sedative. If there is no vomiting, castor oil ʒii to iv (8–15 c.c.) or sal Rochelle, ʒii to iv (8–15 Gm) may be used.

Later, milk of magnesia, ʒss (15 c.c.), Liquor magnesii citratis, ℥iv to viii (180–240 c.c.), Hunyadi water, ℥iii to vi (90–180 c.c.), or cascara preparations may be given, or an enema may effect the purpose. If there is much vomiting during the course, the enema will be the better choice of methods. If hyperæsthesia is very marked, the oral administration may be less annoying.

Treatment of Nausea. Almost invariably vomiting occurs with the onset of the disease. Sometimes it continues for days. It is also a feature of the long-standing cases.

Not only is the vomiting exhausting in itself, but it makes feeding difficult. The **vomiting** is probably central and may occur without nausea. Measures directed at the stomach itself would seem then to promise little unless some gastric irritability in addition existed. We may, however, try such expedients as **cracked ice**, a **mustard paste** one in four of flour to the pit of the stomach, **sodium bicarbonate** gr. x–xv (0.60–1 Gm) in a little water, bismuth subnitrate gr. x–xv (0.60–1 Gm) stirred in a little water, or cerium oxalate gr. iii to v (0.20–0.30 Gm) in the same way, or all in combination.

Feeding is sometimes possible by the stomach tube, when otherwise rejected.

Treatment of symptoms.

As one might anticipate from the nature of the lesion, symptoms referable to cerebral irritation are dominant.

Restlessness, delirium and **sleeplessness** demand attention.

The application of the **ice-cap** or **ice coil** is a helpful measure and the sedative effects of **warm sponge baths** are to be kept in mind.

Of the drugs in the milder cases one has recourse to **bromides,** for the more severe **codeine** and **morphine** or even **hyoscine** in doses determined by age and severity, e.g., bromides gr. iii–v (0.20–0.30 Gm) three times a day at one year or gr. v–x (0.30–0.60 Gm) at five years.

Codeine gr. 1/60–1/30 (0.001–0.002 Gm) at one year and gr. 1/10–1/5 (0.006–0.012 Gm) at five years or in severe cases morphine gr. 1/200–1/100 (0.0003–0.0006 Gm) at one year to gr. 1/30–1/20 (0.002–0.003 Gm) at five years.

Hyoscine to a child of five years may be given if above drugs fail, in doses of gr. 1/800–gr. 1/400 (0.000075–0.00015 Gm).

Convulsions. Slight twitchings may be controlled by the use of chloral, best given by the rectum in small amounts of warm milk reinforced by bromides by mouth or rectum.

Severe convulsions require morphine.

The **circulation,** attacked by the toxins of the disease and feeling the effects of their action and that of intracranial pressure on the medullary centres, needs support and yet its impairment is not, as a rule, as great as one might anticipate.

For continuous support we rely on digitalis or strophanthin or for immediate demands on caffeine.

Do not use strychnine on account of its exciting effects on motor centers.

Dose. In adults digitalis is given in the form of the infusion ℥ss (15 c.c.) or m. xxx of the tincture (2 c.c.) three times a day for three or four days, or in emergency strophanthin gr. 1/120–1/90 (0.0005–0.00075 Gm) into vein or muscle, followed by digitalis as mentioned. Caffeine in the form of a soluble salt gr. v (0.30 Gm) every four to two hours. Children are given smaller doses according to age or weight.

Bladder. Distension is likely to occur in the stuporous and incontinence is likely to mean an overflow.

Evidence of such a state of affairs is to be sought for by palpation and percussion and efforts at relief afforded by the application of hot stupes over the hypogastrium or if this fails by the use of the catheter.

There is no drug that can be called specific; though urotropin has been greatly recommended with the hope that its presence in the cerebro-spinal fluid (which is demonstrable) might prove bactericidal. Our knowledge of the action of urotropin, however, points to its efficiency as a bactericide only in the presence of an acid medium.

It probably has no action whatsoever in the alkaline cerebrospinal fluid.

It is still recommended but with diminishing fervor.

Specific Treatment. Upon the determination of the diplococcus intracellularis meningitidis as the causative agent of the disease, there followed efforts to find a specific substance to combat it and its effects. The fact that the toxic substance of the organism was found to belong to that class of poisons known as endotoxins, i.e., toxins bound up in the body of the organism itself and not excreted by it as is the case with the diphtheria bacillus, and the fact that antitoxins to this kind of toxin have not been determined made the outlook for success in this direction no better than in the case of other diseases due to endotoxin-bearing bacteria, such as pneumonia, streptococcæmia, etc.

The effort was made, however, to obtain an active serum by the immunization of animals with the meningococcus and as the first efforts at treatment followed the usual lines of subcutaneous or intravenous injections, disappointing results ensued, until the suggestion to inject the serum into the spinal canal reaped a rich reward.

In spite of theoretical considerations the serum does seem to have some antitoxic power, but in no sense owes the total of its efficacy to this. What it does seem to do is to inhibit the growth, induce the death and initiate the disintegration of the diplococcus, while at the same time it has opsonic qualities, encouraging phagocytic activity.

Mode of Preparation. The serum is obtained by injecting into animals (the horse is the animal now preferred) at weekly intervals, increasing quantities of the meningococcus. At first dead bodies are used and it is found that better results ensue if the autolysate (products of self digestion) of the organism is used alternately with the diplococci themselves. The whole course takes from four to six months. Later the live diplococci take the place of dead ones.

Blood is then withdrawn from a vein, the cells separated from the serum and the latter preserved for use.

Dosage. The dosage is limited only by the capacity of the spinal canal. The dose may be taken at 30 c.c. with these modifications: (1) That if more than this amount of cerebro-spinal fluid can be withdrawn from the spinal canal, an equal amount of the serum should replace it. (2) That if less than 30 c.c. is withdrawn from the canal, the dose should approximate 30 c.c. as near as possible without inducing pressure symptoms or rather without forcing against rapidly increasing resistance. Doses less than 30 c.c. are much less efficacious.

Sophian as a result of his studies lays great stress on the blood pressure. He takes a fall of 20 mm. as an indication for halting the injection. Then he waits a few minutes and tries again; if further fall occurs he stops, as he has noted that after a fall of 20 mm. a further fall is apt to be precipitate and dangerous. He gives the average dose as controlled by blood pressure to be

1–5 years	3–12 c.c. serum
5–10 years	5–15 c.c. serum
10–15 years	10–20 c.c. serum
15–20 years	15–30 c.c. serum
20 years and over (occasionally more)	20–40 c.c. serum

(Forchheimer's *Therapeusis of Internal Diseases.*)

Frequency. The dose should be repeated each day for three or four days or longer; longer if the diplococci are found on the stained spread of the cerebro-spinal fluid withdrawn to be still persistent or if active symptoms of the disease continue, even if the fluid seems free from diplococci. It is only in the exceptional case, whose symptoms yield promptly and in which the diplococci have disappeared that fewer doses are permissible.

Results. The results are seen both in the amelioration of symptoms and in the change wrought in the cerebro-spinal fluid.

In the latter the diplococci free in the fluid disappear, then the intracellular organisms undergo changes, that retard or prevent their growth on ordinary media, interfere with their staining properties, then disintegration and autolysis take place with disappearance of the bacteria. The cerebro-spinal fluid, itself, becomes clearer; the pus cells disappear, while in the blood the leucocytosis makes way for a normal count.

The general symptoms show improvement in the lessening of the nervous manifestations, such as delirium, in a lowering of temperature and better circulation and respiration. The improvement is more often gradual, the temperature going down by lysis, but a large per cent. of the cases show a true crisis in the fever and a precipitate improvement in the other symptoms. The disease is shortened by the use of the serum, complications are less frequent and serious sequelæ are lessened.

Bad Results. A disagreeable rather than a dangerous result is serum sickness which occurs much as after diphtheria antitoxin is administered. (See Diphtheria, Chap. X.)

The more dangerous accidents enumerated above, including collapse, have been attributed to anaphylaxis, rapid lysis of the cocci, the effect of the preservative trikresol and increased intracranial pressure. Worth Hale's studies attributed the dangerous results to the trikresol used to preserve the serum as well as to intracranial pressure, but Flexner believes the accidents in the use of serum can not be attributed to anaphylaxis nor to the preservatives and would attribute them all to the increased intracranial pressure.

However, whether due to trikresol or intracranial pressure the fall in blood pressure is a useful guide to approaching danger.

Lumbar Puncture. This procedure is absolutely essential to the diagnosis and to the serum therapy and in addition affords no small measure of relief from certain of the symptoms.

It is an exceedingly simple procedure and practically free from danger, but is often approached by him who undertakes it for the first time with trepidation and seems to the parent who witnesses it an heroic undertaking, both of which facts make for delay in this urgent undertaking.

Site. The site of puncture is determined by a line drawn across the spine at a level with the highest points of the crests of the ilia; a tape or a string stretched between these points gives the point on the spine. The spine of the vertebra nearest this point is the fourth. The point of insertion of the needle is between it and the vertebra above, that is, between the third and fourth or between it and the vertebra below, that is, between the fourth and fifth.

In children choose the exact mid-line; in adults choose a point 3/8 to 1/2 inch to the right or left of the mid-line, directing the point of the needle inward, i.e., towards the mid-line, going in between the laminæ.

Position of the Patient. If a child it should lie on its side at the edge of the bed or table with its back towards the operator. An assistant then bends the child forward, by gently pressing the head down and the knees up so that the spine curves boldly outwards, thus separating the spines of the vertebræ from each other and making the puncture easier. This position is preferable to the sitting posture chosen by some operators.

Preparation of the Patient. The skin all about the site of puncture should be cleansed with soap and water and then with alcohol. One may well paint the site of puncture with tincture of iodine in addition or may dispense with the alcohol if using the iodine.

Preparation of the Operator. The hands should be cleansed with the same precautions as for a more considerable operation; thoroughly with soap and water, followed by alcohol or one may use sterile gloves.

Preparation of the Apparatus. All the apparatus used should be rendered sterile by boiling. Appropriate needles or trochars and canulas, a syringe and test-tubes constitute the paraphernalia.

Anæsthetic. It is better to do without an anæsthetic. The pain is but slight, as patients have testified, and the use of an anæsthetic complicates the procedure. If an older child or adult is fearful of pain or the parents insist, a local anæsthetic in the shape of ethyl chloride to freeze the site of puncture, or cocainization with 1 per cent. to 2 per cent. cocaine is to be preferred to general anæsthesia; if this may not be employed, a few whiffs of chloroform may be given. Deep anæsthesia is entirely unnecessary and adds discomforts and dangers.

Needle. One may use a needle or a trochar and canula. The needle should be stiff of a fairly good calibre. The exploratory needles used for paracentesis of the thorax or other cavity or antitoxin needles, the bore and length depending on the age of the patient, may be used, or a trochar and canula or a special lumbar puncture needle, after the pattern of Quincke.

I have found the exploratory needles the most satisfactory.

The Tap. When the point of entrance has been determined, it is well to use the thumb of the left hand, with the edge of the nail on the upper border of the lower vertebra bounding the space as a guide and push the needle along the back of the nail firmly and slowly until a lessened resistance tells of entrance into the space, of which the flow of fluid is corroborative, when the open end of the needle is released or the trochar is withdrawn. Care should be taken not to rudely push the needle across the cerebro-spinal cavity against the body of the vertebra as bleeding ensues and interferes with an examination of the fluid.

The depth to which the needle is carried is in children about an inch. In adults it is considerably more and the needle should be at least 4 inches long.

The flow may be drop by drop, but is usually continuous or may spurt in a stream, depending on the pressure and the bore of the needle.

The amount varies from a few c.c. to 50 or 60 c.c. or more. Twenty to 30 c.c. are common figures. (Normal infants 10 to 20; older children 15 to 25. Pfaundler.)

Collecting the Fluid. One should have test-tubes 15 to 20 c.c. at hand, sterile or rendered sterile by boiling with the needles and syringe. The open end of the tube is put under the flow and filled three quarters full, leaving room to introduce a sterile cotton plug without touching the fluid. If the fluid runs a little bloody at first this tube as soon as the fluid runs clear, makes way for another tube to catch the clearer fluid. Let all run that will, catching in several tubes.

Sophian takes the blood pressure during the tapping and if it falls 10 mm. Hg. he discontinues the flow.

After plugging the tubes they should be set upright and left undisturbed until examined.

Appearance of the Fluid. The fluid should be purulent or turbid, but the rule is not invariable. When the case is one of meningitis clinically, a fluid which is purulent or turbid indicates serum at once without awaiting the examination of the fluid. Again if the fluid is bloody and obscures the appearance of the fluid the serum should be given.

Only in case the fluid is watery clear should one await for the results of an examination, for in this case it is in all probability a case of tubercular meningitis, serous meningitis or poliomyelitis.

In other words always give the patient the benefit of every doubt in giving him the serum, for it is in itself harmless.

Injection. The syringe is filled with serum, which should be warmed to about the temperature of the blood, the air expelled and then connected with the needle. The injection should be made very slowly, the patient watched carefully for evidences of collapse, poor pulse, cyanosis, embarrassed breathing, upon the appearance of which some of the serum should be allowed to flow back through the needle until improvement occurs. Dunn advises the wise precaution of keeping the needle in situ for a few minutes after the serum has been injected, so as to make unnecessary another puncture, if signs should develop.

Some clinicians deem they facilitate the diffusion of the serum in the cord by raising the foot of the bed.

Instead of the syringe the **gravity method** may be used and is to be **preferred.**

Special apparatus is on the market for this purpose or one may use the barrel of a 15–25 c.c. syringe as a funnel, to which is attached a 12–14 inch long rubber tube about ¼ inch in diameter with metal end piece to fit end of needle (Sophian).

This method will probably replace the older, as it is difficult to produce a trauma by it, the inflow is more even and slower and if bad symptoms arise, the fluid can be drawn off by simply lowering the funnel.

If the severe symptoms described ensue, allow some of the fluid to escape.

If breathing is bad artificial respiration may be instituted.

Atropin in doses gr. 1/80 to gr. 1/50 (0.00075–0.0012 Gm) and cocaine gr. ⅛ to gr. ¼ (0.008–0.015 Gm) is advised (Sophian).

Reaction. Headache or pain in the back and limbs may ensue or on the other hand the patient may be rendered more quiet, but as a rule no bad reaction follows.

Headache may be relieved by raising the pillow. If it is very severe morphine may be used.

After the needle is withdrawn, sterile adhesive plaster or collodion may be used to seal the puncture.

Dry Tap. Dry taps are usually due to failure in technique. For this reason all preparations for puncture should be carried out with precision; the child held firmly in the position desired, the landmarks carefully determined and the thrust made firmly with constant regard to the direction. With repeated punctures the patient becomes more alarmed and the whole procedure made more difficult. It means in the great majority of cases that the canal was not entered. If one feels sure that he has entered the space and no fluid is obtained, he may introduce a sterile wire through the needle to clear it from a plug of tissue that may be occluding it and if not successful in this manœuvre, withdraw the needle and go in a space above or below.

The dry tap may be due to inspissation of the fluid. Raising the patient to a sitting position may initiate the flow, or a little salt solution may be gently forced in or the use of two needles in adjacent spaces with saline irrigation between them has been advised.

In true dry tap one may force much smaller amounts in at more frequent intervals. No great pressure should be used.

In this city the serum is now prepared by the Board of Health (New York).

Early Usage. There is no one fact more emphasized by statistics than that every hour of delay in the usage of the serum adds an appreciable percentage to the mortality. Flexner and Jobling, analysing over 350 cases, show that when the serum was administered on the first to the third day, in 123 cases the mortality was 16.5 per cent., on the fourth to the seventh day in 126 cases the mortality was 23.8 per cent., and later than the seventh day of 112 cases the mortality was 35 per cent.

Fulminating Cases. The overwhelming rapidity of these cases does not permit of timely intervention on the part of the physician. The patients are profoundly affected when seen.

The condition is a true bacteriemia.

More frequent dosage as Dunn urges seems rational. He advises a dose at once and another as soon as the beneficial effects begin to wane, which may be in a few hours, or to give the dose at twelve hour intervals.

In addition to the administration of the serum by the intradural method one may give it by the subcutaneous or intravenous method, in amounts of 75 to 100 c.c.

Chronic Cases. In the prolonged cases, as long as there are diplococci in the fluid or fever or pain or symptoms of activity of the process in any terms, except a rigidity of the neck and Kernig's sign, which are apt to persist for some time after complete disappearance of other symptoms, the treatment should be continued. Dunn has advised as a routine that after four doses on consecutive days, a wait of a few days follow and then again a course of four treatments be given and again a wait and so on until all signs disappear.

Sophian has used in the chronic cases meningococcic **vaccine** as an adjuvant to the serum treatment. The doses are 50,000,000, up to 1,000,000,000 or 1,500,000,000 every three to five days.

Hydrocephalus in the chronic cases demands taps at daily intervals or once in two, three, or four days depending on symptoms.

Relapses. Relapses occur in a small per cent. of the cases, though Ker found that 15 to 20 per cent. of his cases relapsed.

A relapse is to be treated like a fresh case, that is, by daily injections for three or four days.

Exacerbations in the course of a case are to be treated in the same vigorous manner.

When the spinal fluid is too thick to run through the needle, it has been advised to use a sterile physiological salt solution to irrigate the cord and then inject the serum.

When for other reasons the tap is dry and particularly in infants a puncture into the ventricles has been made, the cerebro-spinal fluid withdrawn and the serum given into the ventricles.

Puncture of the Ventricles. In posterior basal meningitis, the use of serum by the intradural method is hazardous and useless. The hydrocephalus demands puncture of the ventricles daily or less often according to the severity of symptoms.

If the fluid is infected serum is injected into the ventricles as into the cord.

This procedure is not difficult in infants. The anterior-fontanelle is used. One enters at the lateral border, pushes the needle down, back and in to the depth of 2 to 4 cm.

Use the same needle as in lumbar puncture.

In older individuals the puncture must follow a trephining.

Results. The mortality in different epidemics in different localities showed about 75 per cent. The analysis of the first 400 cases after the introduction and use of the antitoxin reversed the figures; 75 per cent. recovered and 25 per cent. died.

Of infants under one year, before the introduction of antitoxin the mortality was approximately 100 per cent.; a recovery a rarity. After the introduction of antitoxin, of the first twenty-two treated 50 per cent. recovered.

In 1914 Flexner reported on 1,294 cases treated with his serum. The mortality was 31 per cent.

For those treated on the first to the third day the mortality was 18 per cent., on the fourth to the seventh day 27 per cent. Later than the seventh day 36.5 per cent.

The highest mortality was under one year, 49.6 per cent.; the lowest from five to ten years, 15.1 per cent.

Thirty per cent. of the cases reported by Flexner ended by crises.

In a few cases, he says, the meningococci seem to be serum fast; and in a number of relapses the cocci seem to have acquired serum fastness and defeat the effort of the serum.

Complications. Changes in mentality, varying from irritability and changes in disposition to profound damage together with different paralyses may ensue.

Relief of intracranial pressure must be afforded by frequent tappings, by the use of the vaccine and serum.

Eye complications are varied in type, in part due to effects on centres from pressure or meningo-encephalitis and to be treated by tapping and the use of serum and vaccines; and in part local, such as severe conjunctivitis or even suppurative processes.

These are to be treated as under other circumstances, but the use of the serum locally may help materially.

Ear. Otitis is very common, occurring in over 10 per cent. of the cases and is to be treated by paracentesis.

For treatment of Otitis media see Scarlet Fever Chap. IX.

Deafness is another unfortunate issue.

Joints. An involvement of the joints takes place in 15 per cent. of the cases and may be a polyarthritis, lasting weeks or months.

Vaccines (see text) are indicated.

Fluid may be removed from a joint and serum injected (e.g., 10–15 c.c. into knee) with great benefit.

Septic pneumonia is a most grievous complication and **meningococcic endocarditis** another.

The malignancy of these processes makes a fatal issue certain.

They are fortunately not common. Our duty demands the use of the serum under the skin or into the vein, together with the use of vaccines, in spite of the mournful outlook and measures aimed at comfort and support.

See Pneumonia, Chap. IV.

Pyelitis is fairly common.

Meningococci may be found in the urine even before they are determined in the cerebro-spinal fluid.

Urotropin should be used. (See Typhoid Fever, Chap. V.)

In severe cases, subcutaneous or intravenous use of serum and the use of vaccines would be indicated.

Prophylaxis. Protection of the individual.

Serum may be used subcutaneously, just as diphtheria antitoxin to afford passive immunity and it has been claimed that it affords such immunity over a period of two to three weeks.

It would be indicated for those who find themselves in immediate contact with a patient, doctors, nurses, and members of the patient's family.

What is believed to afford a more lasting and effectual protection is afforded by vaccines.

These vaccines have been given in the same doses and at the same intervals (weekly) as the antityphoid vaccine; namely, 500,000,000–1,000,000,000; but Sophian, because of the rather striking pain in the neck, which alarmingly suggests the real disease, after the initial injection, recommends as a first dose, 100,000,000, followed in a week by 500,000,000 and in another week by 1,000,000,000.

Carriers. Fifty per cent. and in some epidemics even a much higher per cent. of contacts become carriers, and infection through the third person is common; 95 per cent. of these carriers do not suffer themselves.

All contacts should be examined and those found to be "carriers" should be quarantined until their nasal discharges are negative for the meningococci on two occasions, and Sophian advises that those contacts be quarantined a week even when the discharges are negative.

In quarantine they should use the mild antiseptic sprays, such as 2 per cent. boric acid solution or quarter strength Dobell's solution.

Sophian lays great stress on the use of saline douches three times a day, followed by a spray of peroxide of hydrogen ½–1 per cent.

Others recommend the blander silver preparations, but astringents that irritate the mucous membrane and so lower its resistance should never be used.

SUMMARY

Distribution of the family.

The disease is contagious and isolation should be obligatory.

The children of the family and other "contacts" should be kept from other children, as possible carriers.

The children of the family should be isolated over a period that probably covers the illy defined incubation period; i.e., three to four weeks.

The nasal passages of the suspects should be examined for diplococci.

Adults, too, should be kept from the sick-room unless their duty keeps them there.

Adults of the family should not come in contact with other children and if their duty brings them in contact with children, they should remove from the environment of the patient and submit to the isolation period before seeing children again.

Contacts should have their nasal secretions examined. If they are positive, they should keep from children during the epidemic.

Avoid infections of nasal passages, especially during epidemics of colds and sore throats.

''Contacts'' should use a mild spray for the throat and nose, 2 per cent. boric acid solution or quarter strength Dobell's solution.

Never use strong astringents.

Nurse.

Some cases a night and day nurse.

Very likely to become a ''carrier.''

Avoid contact with children.

Remember the ease of conveyance by kissing, coughing and sneezing.

Before going out clean hands and face with soap and water followed by alcohol or 1–1,000 bichloride and

Spray throat and nose with the mild solutions mentioned.

Should spray throat and nose from time to time while on duty.

Physician.

Should make his visits as short as is compatible with his full duty.

On leaving, wash face and hands with soap and water followed by alcohol or bichloride 1–1,000.

He should not see another child at once.

Room.

Choose with reference to light.

Air.

Verandah or porch approach.

Bath room near by.

Should be stripped of furnishings.

Carpet lining or unbleached muslin on the floor.

Screens for the eyes, if sensitive to the light.

Avoid jars, noise and other sources of irritation.

Precautions in the sick-room.

Nasal and oral secretions should be received on rags and burned or disinfected in 1–20 phenol or 1–500 bichloride.

Thermometer.

Should be left in sick-room and kept in 2 per cent. phenol or in formalin.

Eating utensils.

Boil in sick room, or if sent out of sick room soak in phenol 1–20 for twenty minutes to half-hour, then send out to be boiled.

- Clothes.
    - Soak over night in 1–20 or 1–50 phenol, then boil half-hour before sending to the family wash or laundry.
- Urinals, bed-pans, etc.
    - 1–20 carbolic or 1–500 bichloride.

Bed.

- (For technique of bed making, see Pneumonia, Chap. IV.)
- Especial care should be taken on account of bed-sores.
- With any threat of bed-sores
    - Air mattresses or
    - Water bed.
- Clothing somewhat more abundant than usual on account of extreme sensitiveness to cold.

Patient.

- Isolation.
    - Nightgown should be of light flannel or, if irritating, cotton. Should be open all the way down the front to facilitate examinations.

Diet.

- Early days do not force.
- Later consider the body needs.
- Articles of diet, see text.
- In infancy modified milk is to be further diluted.
- In stupor or dysphagia.
    - Nasal or oral gavage.
    - Nasal better in children; oral in infancy.
- Drinks.
    - Water, alkaline waters, fruit juice as lemonade, etc.

Care of body.

- Skin.
    - Cleansing bath of soap and water daily.
- Bed-sores.
    - Prevention. Change of position.
    - Scrupulous dryness; use of rings and cushions.
    - Rubbing of skin with hands.
    - Use of alcohol and talcum powder.
    - Care of bed in avoidance of wrinkles and crumbs of food.
    - When sores threaten, use air mattresses or water beds.
    - Sores should be handled on surgical principles.
- Mouth and nose.
    - Remember that the secretions are infectious.
    - Rinse mouth with plain water, then with
    - Boric acid solution 2 per cent. to 4 per cent. or with
    - Dobell's solution quarter to half strength.
- Teeth.
    - Brushed with soft brush or cotton swabs, wet with above solutions, care being taken to free interstices from particles of food.

- Remove particles between gums and cheeks.
- Sordes and coated tongue.
  - Soften with half strength official peroxide of hydrogen, then scrape tongue with edge of whalebone.
  - Follow with the boric acid or Dobell's solution.
- Dry mouth and tongue.
  - Use 2 per cent. boric acid solution.
  - Albolene āā.
  - Flavor with lemon-juice.
- Nose.
  - Soften hard secretions with olive oil.
  - Spray with boric acid or Dobell's solutions.
  - Burn all secretions as infectious.
  - Nurse should carefully wash hands and use alcohol or 1–1,000 bichloride as an antiseptic after these ministrations.
- Eyes.
  - Mild conjunctivitis is common.
  - Secretions are probably infectious and should be burned.
  - Cleanse eyes with 2 per cent. boric acid solution.

Care of bowels.

- Open freely at the beginning.
- Calomel, gr. ¼ (0.015 Gm) every quarter hour for four or five doses, or gr. 1/10 (0.006 Gm) every ten minutes for ten doses. Follow in two to three hours by milk of magnesia ℥ss (15 Gm) if there is vomiting,
- Castor oil ʒii–iv (8–15 Gm) if there is no vomiting; or
- Sal Rochelle ʒii–℥ss (8–15 Gm) or
- Epsom salts ʒii–℥ss (8–15 Gm) in half to three quarter glass of water.
- Throughout the illness use,
  - Milk of magnesii ʒii–℥ss (8–15 Gm) or
  - Liquor magnesiæ citratis ℥iv–viii (120–240 Gm),
  - Hunyadi or similar water.
- Enemata, especially if there is vomiting, though hyperesthesia may make it a too distressing procedure.

Nausea.

- A feature of the onset is vomiting, and it may continue for some time.
- One may try
- Cracked ice.
- Mustard paste, 1 in 3, 4, 5, or 6 of flour to pit of stomach.
- For technique see Pneumonia, Chap. IV, or

Sodium bicarbonate	gr. x–gr. xv (0.60–1 Gm)	or
Bismuth subnitrate	gr. x–gr. xv (0.60–1 Gm)	or
Cerium oxalate	gr. iii to gr. v (0.20–0.30 Gm)	or

a combination of the three.

- Lavage.

Treatment of symptoms.

Restlessness, delirium, sleeplessness.

- Ice-cap or ice-coil.
- Warm sponge baths.
- Bromides, in doses gr. x to gr. xxx (0.60–2 Gm) according to age.
- More severe.
  - Codeine, in doses of gr. 1/48–gr. ss (0.0015–0.030 Gm) according to age.
- Very severe. Morphine in doses of gr. 1/48–gr. 1/4 (0.0015–0.015 Gm).
  - Hyoscine hydrobromate in doses of gr. 1/300–gr. 1/100 (0.0002–0.0006 Gm) in adults.

Convulsions.

- Slight twitchings.
- Chloral best given by the rectum in warm milk.
- Dose, gr. v to gr. xxx (0.30–2 Gm) according to age.
- Bromides may be added to the chloral in double the dose of the latter, and may be given by mouth or rectum.
- Severe convulsions.
  - Morphine, doses of gr. 1/24 to gr. 1/3 (0.003–0.020 Gm).
  - For details of treatment of convulsions in children see index.

Circulation.

- So far as influenced by the intracranial pressure, do a lumbar puncture.
- For continuous support use digitalis in
  - doses of gr. ss to gr. iii (0.030–0.20 Gm) three times a day (ʒss to ℥ss of infusion (2–8 c.c.)
  - m. v to m. xxx (0.30–2 c.c.) tincture).
- Strophanthin in emergency in
  - doses of gr. 1/120 to gr. 1/60 (0.0005–0.001 Gm).
- For immediate demands.
  - Caffeine in
    - doses of gr. ss to gr. v (0.030–0.30 Gm) every two hours as a soluble salt of caffeine sodium salicylate or sodium benzoate.

Bladder.

- Watch for distension.
- Apply hot stupes over the epigastrium.
- Catheterize.
- Urotropin.
  - Doubtful value.
  - dose, gr. v (0.30) two to four times a day well diluted.

Specific treatment.

- For preparation of serum and the theory of its action see text.

Administration of serum.

- Intraspinal.
  - Dosage.
    - Only limited by the capacity of the spinal canal. Rule, 30 c.c.

or if more than this amount of cerebro-spinal fluid is withdrawn from the canal, replace an equal amount of serum.

If less than 30 c.c. of cerebro-spinal fluid is withdrawn, approximate the dosage of serum to 30 c.c. but without forcing against resistance.

Sophian is guided by blood pressure readings. (See text.)

For Sophian's table of dosage at different ages see text.

Frequency of dosage.

- Once a day for three or four days or longer if meningococci persist in the cerebro-spinal fluid or the symptoms are active.
- Favorable results are shown by amelioration of symptoms and change in cerebro-spinal fluid.
- For details see text.

Lumbar puncture.

- Site. In a line with the iliac crests. Crosses spine nearest to fourth lumbar.
  - Go in between fourth and third lumbar or between fourth and fifth lumbar.
  - In children enter needle in exact mid-line of vertebral column.
  - In adults enter 3/8″–1/2″ to right or left of mid-line and direct needle inward toward the middle line.
- Position of the patient.
  - On his side with back toward the edge of the bed or table, head and knees approximated.
- Preparation of patient.
  - Wash site with soap and water and alcohol or
  - Paint the site with tincture of iodine.
- Preparation of the operator.
  - Prepare as for a surgical operation.
  - Soap and water and alcohol or sterile gloves.
- Preparation of the apparatus.
  - All should be sterilized by boiling; needles, trochars and canula, syringe and test tubes.
- Anæsthetic.
  - Better none; pain is trivial.
  - If fear makes it advisable freeze site with ethyl chloride or use 1 per cent. to 2 per cent. cocaine solution or give a whiff of chloroform.
- Needle.
  - Should be stiff and of fairly good calibre, such as is used for thoracentesis or diphtheria antitoxin administration.
  - Trochar and canula.
  - Quincke needle.
- The Tap.
  - Guide needle along upper thumb-nail pressed against upper border of lower vertebra bounding the space to be entered.
  - Lessened resistance tells of entrance of needle into canal.
  - Flow through needle corroborates entrance.
  - Don't push needle across space into body of vertebra, lest bleeding ensue and spoil fluid for examination.

- Depth of entrance.
  - In children about 1″, in adults more.
  - Needle should be 4″ long at least.
- The flow.
  - May be drop by drop; but is usually continuous or in a spurt.
- The amount.
  - Normal infants, 10 to 20 c.c.
  - Older children, 15 to 25 c.c.
  - Adults, 20 to 30 c.c.
  - May vary in meningitis from a few c.c. to 50–60–100 c.c.
- Collecting fluid.
  - Sterile test-tubes 15 to 20 c.c.
  - Fill not more than three quarters, so that plug of cotton will not touch.
  - If fluid runs bloody, catch this in one tube and the clearer in the other.
  - If blood pressure falls 10 mm. during the tapping it is well to discontinue.
  - Plug and set upright.
  - Let all flow that will, or
  - Taking blood pressure, if it falls 10 mm. stop (Sophian).
- Appearance of fluid.
  - Usually turbid or purulent.
  - Don't wait for examination, but give the serum.
  - If blood obscures it, don't wait, give serum.
  - If watery clear, wait and examine. May be tuberculous or serous meningitis or poliomyelitis.
  - Give patient benefit of any doubt by administering the serum.
- The injection.
  - Fill the syringe with serum warmed to blood heat.
  - Inject slowly.
  - Watch for poor pulse, cyanosis, embarrassed breathing, collapse and let serum flow back until improvement occurs.
  - Keep the needle in situ for a few minutes to avoid necessity for another puncture, if symptoms develop (Dunn).
  - Some advise raising foot of the bed to facilitate diffusion.
  - If bad symptoms develop as above, let some fluid escape.
  - Do artificial respiration.
  - Atropin, gr. 1/60 (0.001 Gm).
  - Cocaine hydrochlorate, gr. 1/8–1/4 (0.008–0.015 Gm) hypodermically (Sophian).
  - For **gravity method** see text. Coming to be the preferred method.
  - Severe symptoms during injection cardiac, respiratory or collapse.
  - Let some of the fluid (serum) escape.
  - Artificial respiration.
- Atropine, gr. 1/80–gr. 1/50 (0.00075–0.001 Gm). Adult dose.
  - Children, dose gr. 1/800 to gr. 1/100 (0.00008–0.0006 Gm).
  - Cocaine hydrochlorate, gr. 1/8–1/4 (0.008–0.015 Gm). Adult dose.

- Reaction.
  - As a rule none of consequence. May be headache, pain in back and limbs.
  - Raise the pillow.
  - Morphine, dose, smallest that will relieve pain, gr. 1/48 to gr. 1/4 (0.0015–0.015 Gm).
- Dry tap.
  - Usually due to failure in technique.
  - Canal is not entered.
  - Needle is plugged with tissue.
  - Try a space above or below.
  - Fluid may be inspissated.
  - Sitting patient up may initiate the flow.
  - Saline irrigation under slight pressure, two needles in adjacent spaces with saline irrigation.
- True dry tap.
  - Use small amount under gentle pressure at shorter intervals.
- Early usage of first importance.
  - For statistics see text.

Fulminating cases.

- More frequent doses, twelve hours or less (Dunn).
- Also subcutaneously or intramuscularly or intravenously in doses of 75–100 c.c.

Chronic cases.

- Continue treatment as long as diplococci persist, or there are active symptoms, such as fever and pain.
- Stiff neck and Kernig's sign may outlast the infection.
- Give a dose four days in succession, then wait a few days, another series and so on, until signs disappear (Dunn).
- Sophian uses
  - Meningococci vaccine in addition to the serum.
  - Begin with 50,000,000 and increase up to 1,000,000,000 or 1,500,000,000.
  - Give at three to five day intervals.

Hydrocephalus.

- Tap every day or once in two, three or four days according to symptoms.

Posterior basic meningitis.

- Tap ventricles daily or less often according to symptoms.
- Intradural injection of serum dangerous.
- If ventricular fluid is infected inject serum into ventricles as into cord.
- Tapping ventricles.
  - Infants.
    - Enter by anterior fontanelle at lateral border, push needle down, back and in 2 to 4 c.m.
    - Use same needle as in lumbar puncture.

  - Older individuals.
    - Trephine.
- Complications.
  - Mental disturbances.
  - Frequent tapping.
  - Serum.
  - Vaccines.
- Eye.
  - Special treatment.
  - Serum applied locally.
- Ear.
  - Otitis.
    - For treatment see Scarlet Fever, Chap. IX.
- Joints.
  - Vaccines.
  - Remove fluid and inject serum.
- Pneumonia.
  - (See Pneumonia, Chap. IV.)
  - Serum under skin or into vein.
  - Vaccines.
- Endocarditis.
  - As under other circumstances.
  - Serum into vein or under skin.
  - Vaccines.
- Pyelitis.
  - Urotropin.
  - Vaccines.
  - When severe.
    - Serum under skin or into vein.
- Relapses.
  - Treat as a fresh case.
- Exacerbations.
  - Treat vigorously as a fresh case.

Prophylaxis.

- Individual.
  - Passive immunity.
  - Serum subcutaneously.
  - Last two to three weeks.
  - More lasting immunity.
  - Vaccines.
    - One hundred million, a week later
    - Five hundred million, and then a week later
    - One billion.

Carriers.

- Quarantine until discharges are twice negative.

CHAPTER XVIII

POLIOMYELITIS

(INFANTILE PARALYSIS)

THIS disease, so dreaded because of its frightfully crippling effects, is undoubtedly of microbic origin.

A minute globular organism, so minute as to pass through the pores of a Berkfeld filter, has been detected in the central nervous system, cultivated and made to reproduce the disease in monkeys by Flexner.

The virus is conveyed by individuals infected or commonly by "carriers"; that is, those who having been in contact with the sick, though not themselves infected, can carry the virus to a susceptible person and infect him.

The rôle played by insects in transmitting the disease is small and, indeed, questionable.

The portal of entry seems to be the upper air passages, especially the nose, and the virus passes from here to the olfactory lobes, spinal cord fluid and thence to the nervous tissue for which it has a special affinity.

Protection of the Community. The focus from which all epidemics radiate is the patient sick with the disease in question. Protection begins then with sufficient isolation of this individual, so that there shall be no immediate contact between him and a susceptible individual and this can be readily accomplished when understanding and willingness on the part of those concerned cooperate.

But another source of infection beside the patient frankly sick is the abortive and ambulatory case and only a sufficiency of skill in diagnosis of this group of cases can be of avail in eliminating him as a source of infection.

Another source of infection is the "carrier." The carriers may be divided into two groups; first, those who have been in contact with the sick and though uninfected themselves carry a virulent organism about with them and those who have had the disease, have recovered and yet carry about virulent organisms, like the diphtheria and typhoid carriers.

Flexner has called attention to these four groups.

Isolation. Those in contact with the patient should be kept isolated, so far as possible for three weeks and if this is not possible should at least avoid contact with children; children should not be allowed to go to school or to public gatherings.

Nose and throat should be sprayed or gargles used of some antiseptic, such as 1 per cent. peroxide of hydrogen, official strength.

The abortive cases are to be especially looked for in epidemics.

A diagnosis of an abortive case of poliomyelitis is at best conjectural and when occurring as a sporadic case scarcely possible, but in an epidemic symptoms of an acute infection, in which the febrile reaction is accompanied by excessive irritability and hyperæsthesia should arouse suspicion; sweating, stiffness of the neck or gastro-intestinal symptoms may be accompanying features.

When such a diagnosis is suspected the spinal cord fluid should be examined.

This is clear, contains a moderate increase of cells and an increase of globulin.

In the first week the cells are more numerous and the globulin scant or absent. In the early days many cells may be polynuclears.

Later in the second and third weeks, the cells decrease, the proportion of polymorphonuclears decrease and the lymphocytes and mononuclears increase. The globulin reaction becomes more striking. Rarely do the cells reach a thousand; more commonly a few hundred or only 10 to 100.

The fluid may appear normal.

This picture may be given by tuberculous meningitis and syphilitic myelitis, so there is absolutely no diagnostic feature in the symtomatology or findings, but such a spinal fluid added to the general symptoms given above, occurring during an epidemic makes a diagnosis of poliomyelitis fairly certain and from the practical standpoint imperative. The blood shows a leucocytosis; sometimes as high as 30,000, and an increase of 10 per cent. to 15 per cent. in the polymorphonuclears.

These cases are to be isolated in the same way as the frank cases and those exposed to such a case treated as those exposed to a frank case.

More difficult is the problem of chronic carriers. We know that the infection resides in the secretions of the nose and in the saliva and has been found in the tonsils and pharynx.

The organism has been found, described and cultivated by Flexner and his workers and the infectivity of secretions determined by inoculation into monkeys, but a ready method of determining the infectivity of the secretions of suspected "contacts" and of patients recovered from the disease awaits elaboration.

In the meantime, such contacts and convalescents should be kept especially from children and their nose and throat treated with mild antiseptics.

Isolation of the Patient. I feel that sufficient emphasis has not been laid on complete isolation of these cases. In the last New York epidemic I saw and treated a great many cases in the open wards and did not see a spread of the disease within the ward, but I believe that the rarity of cases among contacts gives us a false sense of security. Hill's studies in Minnesota (quoted by Lovett and Richardson) on the relative transmissibility of this disease with other well known contagious diseases showed that 22 per cent. of those exposed to Scarlet Fever contracted the disease, to Diphtheria 17 per cent., to Infantile Paralysis 6 per cent. Studying exposures in single families, 40 per cent. contracted Scarlet Fever, 30 per cent. Typhoid Fever, 29 per cent. Diphtheria and 17 per cent. Infantile Paralysis; moreover, in some epidemics as high as 40 per cent. of houses or families affected showed more than one case.

These figures as well as the knowledge of the infectivity of the dust from infected rooms (Thro) the conveyance of the disease by healthy individuals, all seem to me to demand as strict an isolation for these cases as for Scarlet Fever and I recommend the rules laid down in that chapter as applicable here. See Scarlet Fever, Chap. IX.

Rules for Disinfection in the Patient's Room. All secretions and excretions should be destroyed, those from the nose and mouth best received on rags or gauze and burned. For the mode of disinfection of secretions, excretions, articles in use about the patient, clothes and bedclothes. See Typhoid Fever, Chap. V.

Doctors and Nurses. It should be remembered that cases have appeared in or through individuals only once in contact with a patient and that a short time.

The physician and nurse should take the same precautions then, as when treating a scarlet fever case and the precautions to be taken in the sick room and on leaving the sick room should be the same. See Scarlet Fever, Chap. IX.

Room. A light, well ventilated room should be chosen, stripped of furniture, carpets, rugs, hangings, etc., leaving bare floors or linoleum, so that the floors and wall may be wiped with damp cloths occasionally and these destroyed; for it has been shown that the dust of a room harboring a case is infective and capable of transmitting the disease.

Such a room should be screened, for it has been shown that insects may convey the disease, probably as they do typhoid fever by becoming contaminated with secretions; for virus passes through the gastro-intestinal canal of man and remains active; but that the disease is regularly conveyed by an insect, e.g., the fly, as was once suspected, is highly improbable.

A convenient bath-room and a separate exit from the house are to be considered in the choice.

Bed. The bed should be of the hospital type, a half or at the most three-quarter bed, of iron with woven wire springs and a firm mattress. The bed should be made with care (see index), and the sheets drawn smooth and free from wrinkles.

One must remember the great hyperæsthesia and paralysis and how much a well made bed makes for comfort. Moreover, numerous mechanical contrivances will be used if paralysis and contractures develop and this type of bed facilitates such efforts.

Care of the Body. Cleansing baths of warm soap and water should be given each day and oftener if the sweating is severe. These are to be followed by sterile talcum powders in abundance.

The mouth is cared for as in any of the acute infections and the same measures applied to the care of the nose and genitals. See Pneumonia, Chap. IV.

It must be remembered, however, that the virus is present in the secretions of the mouth and nose and that all secretions should be burned or otherwise destroyed.

The nurse remembering the danger to herself in handling these secretions should wear gloves and sterilize her hands.

Diet. During the acute stage the diet should consist of milk, or milk preparations, cereals, bread, broths, plain or fortified with cereal or farinaceous flours, eggs, custard, rice, ice-cream.

Water or lemonade, orangeade, or other drinks flavored with fruit juices and fortified with sugar may be used.

Later a liberal diet may be allowed and the appetite satisfied.

Treatment of Symptoms. When the diagnosis is made or suspected, the patient should be put to bed for the most important part of his treatment, **rest.**

When one recalls that the essence of the disease is an inflammatory and degenerative process in the motor centers of the cord and bulb it should go without saying that they should rest; and that means that the muscles they subserve must rest; hence, the whole body. A clue to the continuance of this activity of the process is given by the persistence of the hyperæsthesia. When this disappears, it may be assumed that repair has begun in the centers.

Until this time the patient should not be persuaded to try the paralyzed or paretic limbs; but rather forbidden to do so. Even when there are no constitutional symptoms or hyperæsthesia accompanying the paralysis it is better to keep the patient in bed for a couple of weeks.

Bowels. When first seen a cathartic should be given. **Castor oil** ʒii–℥i (8–30 c.c.) **salts,** Rochelle or Epsom ʒj–℥i (4–30 Gm) according to age or **calomel** gr. i to gr. ii (0.060–0.120 Gm) in divided doses, followed by salts.

Later **cascara, compound licorice powder** or **aloin** in doses suited to the age may be given or milder salines such as **Liquor**

magnesii citratis, Hunyadi water, milk of magnesia or occasionally stronger salts as above or castor oil.

Enemata are usually necessary even when cathartics are given, for constipation is a rather striking feature and more marked when the abdominal muscles are paretic.

Urine. In the early days retention may occur. It is necessary then to be on the lookout, as catheterization may be necessary. One should try, first, however, the simple device of running water, water sprinkled on the hypogastrium or heat or cold applied to the hypogastrium.

PREPARALYTIC PERIOD

Fever occurs in this period and disappears soon after the onset of paralysis. It is not a feature of the disease and requires no treatment.

Hyperæsthesia, pain and **sensitiveness** of muscles or limbs to pressure or handling are characteristic if not constant.

Hyperæsthesia and fear of pain on handling lead to striking irritability to which undoubtedly meningeal involvement adds.

The pain may be spontaneous or elicited only on handling. These discomforts are usually more marked in paralyzed limbs, but may occur in limbs which are not paralyzed and, indeed, during the paralytic period.

The discomfort induced by movement often causes the child to hold the part so quiet that it simulates paralysis.

Even the weight of the bed-clothes may cause distress and in such cases cradles over the limb to support the clothes are helpful. At times the application of a light splint to immobilize a limb is grateful to the patient.

Heat is especially soothing and may be applied as **fomentations** or with the **hot water bag**; wrapping the part affected in a thick layer of cotton batten subserves the same purpose.

Drugs. When irritability is the preponderating feature, **bromides,** either the potassium salt or triple bromides may be given with benefit.

When pain is dominant a member of the **coal-tar group,** phenacetin, antipyrin or acetanilid is indicated. (See Summary for dose.)

Salicylates, such as the sodium salts or aspirin are less depressing than the aniline derivatives and sometimes as effectual.

For more severe pain **codeine** or even **morphine** may be necessary. (See Summary.)

Sometimes drowsiness and apathy are present instead of irritability but even then wakefulness may be a feature.

Insomnia which makes such inroads on strength is met by **bromides** or a mild hypnotic such as **trional** or by **codeine.** Stiffness and pain in the muscles of the neck, especially on bending the head forward is common and demands care in handling and intelligent arrangement of the pillows.

Applications of heat should be useful.

Convulsions are very rare and should indicate warm packs and morphine to control the convulsion and bromides to prevent recurrence.

Gastro-intestinal symptoms are so common as to attract attention and during an epidemic a febrile attack accompanied by vomiting should elicit suspicion and concern.

The **vomiting** and anorexia demand rest for the stomach.

The food is stopped entirely or cut down to small amounts. **Sodium bicarbonate** or **bismuth** may be used but it is not commonly persistent nor requires much interference.

Diarrhea may occur, but constipation is the rule. Severe diarrhea indicates **regulation of food; castor oil and bismuth.**

Tonsillitis and **pharyngitis** are sometimes present and the virus has been recovered from the tonsils.

Hot saline irrigations may be used. (See Scarlet Fever, Chap. IX.) Sprays of mild antiseptics and argyrol 15 per cent. to 25 per cent. may be applied.

Use of Urotropin. Because, when administered by the mouth, this drug was found in the spinal cord fluid and because when given to monkeys it was thought that the subsequent infection was modified in severity, it came to be quite extensively used; but careful observations of clinical results following its use holds out no hope from its use and, moreover, the efficiency of urotropin (hexamethylenamine) depends upon its breaking up to set free formaldehyde. This occurs only in acid and not in alkaline media such as the cerebro-spinal fluid.

Pathology. The disease has been called a meningo-encephalo-polio-myelitis, and this term will explain the types of the disease we observe. But it is even more than this for it affects both the white and gray matter of the brain, the cord and the intervertebral ganglia and the abdominal ganglia. Flexner's studies lead him to this conclusion: that the route of infection is in the vast majority of instances, practically always, by the nasal mucous membrane to the lymphatic channels of the olfactory lobes, to the cerebro-spinal fluid, by this to be distributed to the nerve tissues of the cerebro-spinal axis, for which the virus has a special affinity.

Conveyance by the blood must be exceedingly rare in human beings and curiously enough the avidity of nerve tissue for the virus is not sufficient to derive it from the blood vessels unless damage has previously been done to them or to the choroid plexus.

Types of the Disease. Wickman, in his monograph on the disease, which to avoid the common name connoting the pathology, he calls in honor of the two great students of the condition the Heine-Medin's Disease, divides the clinical pictures into eight types,

1. Spinal (the most common) poliomyelitis.
2. Landry's paralysis (ascending or descending paralysis).
3. Bulbar type.
4. Encephalic or cerebral type.
5. Ataxic type.
6. Polyneuritic type.
7. Meningitic type.
8. Abortive type.

These types are not clear cut and merge into one another.

For this reason fewer and more inclusive groupings have been advocated, such as

1. Spinal type.
2. Bulbar type.
3. Cerebral type.
4. Abortive type. (Müller.)

or

1. Upper motor neurone type.
2. Lower motor neurone type.
3. Abortive type. (Peabody, Draper and Dochez.)

The abortive type, whose symptoms are those of a preparalytic period has been discussed.

Wickman has divided this Type into four groups,

1. A group showing symptoms of any general infection.
2. A group showing much meningeal irritation (meningism).
3. A group in which pain is a feature (influenza-like).
4. A group with predominant gastro-intestinal disturbance.

These serve to fix the attention on poliomyelitis during an epidemic.

The ascending and descending spinal types, Landry's paralysis is a rare and highly dangerous type. We are powerless against its advance. As a result of animal experimentation Clark views the possibility of some good arising from subdural injections of epinephrin, as lessening hyperæmia and œdema and delaying degenerative processes in centers supplying the phrenic nerve until immune substances are produced in the body sufficient to save these centers.

The polyneuritic and ataxic types are among the rarer manifestations of the disease.

Meningo-encephalitic Type. As has been said sharp differentiation between the types of Wickman does not obtain; hence, it is better to consider the meningeal and encephalitic cases together.

The symptoms are such as one might expect from involvement of the brain and its covering; headache, irritability, restlessness and sometimes convulsions. In some, apathy or stupor predominate; vomiting is likely to occur. There are pain and stiffness of the neck, disturbances in the rhythm of pulse and respiration; täche cérébrale and there may be Kernig's sign.

As the hydrocephalus develops Macewen's sign may be noted and in infants the fontanelles bulge. The involvement of the centers causes palsies, facial, mono- or hemiplegias, opthalmoplegia, increased reflexes and, later, spasticity.

These symptoms are to be met as described under the section in the preparalytic period and under cerebro-spinal meningitis, Chap. XVII.

Bulbo Spinal Type. Again a sharp differentiation between the bulbar and spinal types is useless, if possible, and they will be considered together.

This is the common well known type of the disease that gave to us the term anterior poliomyelitis.

Most authorities recognize distinct stages that have decided significance from the standpoint of therapeutics.

1. The acute stage; from the onset to and through the spread of paralysis.
2. The stage of recovery in those muscles capable of recovery.
3. The stage of residual and permanent paralysis.

The Acute Stage. All that pertains to the general symptoms of this stage, aside from the paralysis has been dealt with above under the pre-paralytic period.

The essence of the therapy is **rest of function** of the affected parts and hence, the inflamed cord centers supplying those parts. Rest means not only a comfortable bed, careful nursing, devices to find comfortable positions for the painful members, but also freedom from excitement, entertainment and visitors and, particularly, avoidance of pernicious measures of mechanico- or electro-therapeutics, often insisted on by the parents in an eagerness to see something done for the condition.

Beside affording rest we ameliorate the discomforts.

Lovett calls attention to the importance of recognizing the tendency to **contracture** in these first two or three weeks and taking measures to prevent it. This is especially likely to occur in the Achilles tendon. Lovett advises gentle stretching of the muscles and, as a prevention, a box covered with a blanket placed at the bottom of the bed against which the soles of the feet may rest and preserve for the feet a right angle to the legs. The weight of the bed-clothes, which, pressing on a paralyzed part, exaggerates the deformity and encourages contracture, must be taken off by wire cages, stretching clothes across the crib or similar devices. Light splints may be applied to correct the position; pillows and folded blankets may be used for the same purpose and the position of a joint should be changed from time to time.

The best guide to the length of the period of the active cord involvement is the continuance of tenderness in the muscles and joints. It may last two or three months and during this time no active measures should be applied to the affected muscles. **When the bulb is affected** one may see occular palsies, facial palsy and involvement of the tongue, the pharynx and muscles of deglutition. These latter may compel feeding by nasal or stomach tube and entail constant care to keep the mouth and pharynx free from secretions and food particles that may induce a foreign body pneumonia.

Involvement of Muscles of Trunk and Diaphragm. Paralysis of the respiratory muscles is the usual cause of death. The intercostal muscles are almost always affected before the diaphragm.

Death due to this cause may be direct or due to pulmonary complications sequential to the paralysis.

Either set of muscles are capable of carrying on the respiration. It is the involvement of both that is fatal.

In what seems extensive involvement of these muscles hope lies in the fact that improvement may be rapid and substantial because the depression of centers often overflows the site of actual damage. When the **dyspnœa** becomes accentuated **oxygen** may be administered and respiratory stimulants such as **atropine, caffeine** and **strychnine** may be given hypodermically and, these failing, artificial respiration tried, but when one bears in mind the pathological basis of this failure in function he realizes how futile these measures must necessarily be.

The paralysis of the abdominal muscles greatly aggravate constipation and makes the patient more dependent on cathartics and enemata.

Retention of urine must be borne in mind and the measures described above undertaken.

Paralysis of the Extremities. The distribution of the paralysis is weird, often affording combinations topographically and functionally remote from each other.

The legs are involved more commonly than the arms and one leg more commonly than both. The onset of the paralysis is lawless; it being the first manifest symptom in some cases or occurring any day after the onset, though the majority of cases show paralysis within three days. However, the onset of the paralysis may be delayed a week or two.

Again it is difficult to forecast the extent of the ultimate paralysis by the extent in the early days, for the early paralysis may be due to other causes than actual cell destruction such as œdema and pressure of exudate on centers, depressing effects of toxins on centers, or only partial and not necessarily an eventual crippling involvement of a group of cells, in the cord, so that in a very extensive early paralysis complete recovery or slight damage only may follow. Unhappily there is the obverse of the shield and prognosis waits on time.

What is to be done in the acute stage and even more important what is not to be done has been detailed above.

When the acute process has subsided (see above) one should begin the treatment with massage. **Massage** must be begun gently and for short periods of time at first; gradually increasing up to fifteen to twenty minutes two or three times a day.

Heat in the shape of hot applications or baking is a useful adjuvant to the massage.

In this way the nutrition and tone of the muscle is subserved.

Electricity probably has a very limited value. Its use has undoubtedly been greatly abused and led to the neglect of more valuable measures, less striking in their exposition and requiring more skill and perseverance.

Galvanism is applied to the nerve trunks and faradism to the muscles, if they will respond to faradism. Galvanism is supposed to affect the nutrition of the muscles the more, but the contraction under the faradic current constitutes a more distinct exercise.

Passive Movements. Passive movements play an important part in the prevention of contractions, as has been noted above. They also, like massage, have a favorable effect upon the contraction in the affected part.

Active Movements. There is no doubt that the best exercise is that developed along normal lines; that is voluntary movements.

It must be remembered that the extensive distribution of motor centers governing any group of muscles is in a longitudinal direction and that some centers are very likely to escape and that these centers may be educated to take on the function of the destroyed centers in no small degree. Persistency is all important. In intelligent adults an understanding of the problem is of great assistance, but the vast majority of the patients are children and very many of them little children, so that cooperation on their part has to be elicited by indirect methods.

The warm bath, affording both heat and buoyancy, has been advised, in which the child is persuaded to effort by a desire to play with floating toys, or similar devices by which strong desire is made to elicit voluntary effort may be resorted to.

In older children efforts may be systematized.

At first, assistance must be given by the operator to effect the proposed movements, but as the patient's ability is increased less and less help is given, then **resistance exercises** are begun in which the operator makes gentle and then increasing opposition to the patient's movements.

How long these exercises shall be persisted in before recourse to mechanical expedients is had is a nice question, but it should be months. Good authority puts it at a year and a half to two years, and even then one is not sure that improvement may not go on, even when it has been discouragingly slow.

If the patient has achieved all he can with the impaired muscles he still may so educate other groups of muscles that they may take over the function, in some measure, of those rendered helpless by the lesion.

In the case of the legs, the effort to walk should be made, but in a severe case this is obviously impossible without mechanical appliances to afford help.

Apparatus. The apparatus may take the form of crutches, corsets, jackets, braces or splints and is distinctly an orthopedic problem and competent authority should be sought.

At last the problem may become a distinctly surgical one and,

Operative Treatment Is Indicated. Lovett in a masterly article outlines the indications as follows:

1. To correct fixed deformity.
2. To improve muscular function.
3. To secure stability of useless joints.

Such operations are instanced by **transplantation of a tendon** of an active muscle to the insertion of a paralyzed muscle to take over the function of the latter. This should not be an early operation but undertaken only when failure to improve in the paralyzed muscle is without question.

Efforts to stabilize flail joints by **arthrodesis,** or anchylosing of joints by removing their articular cartilages and getting bony union between the members of the joints.

This is especially applicable in the ankle, but such operations should not be undertaken without first carefully acquainting oneself with the indications and contraindications in individual joints.

Other devices may take the place of arthrodesis, such as the use of **silk ligaments** mentioned by Lovett.

Contractures may require cutting and stretching; especially about the ankle and knee.

Prognosis. The mortality runs about 15 per cent., but varies in different epidemics and at different ages.

The percentage of recoveries investigated in one series of 234 cases (quoted by Lovett) showed 25 per cent. to be complete and in another series of fifty-seven cases 28 per cent. completely recovered and 31 per cent. more recovered function, but showed some atrophy. The mortality varies in different epidemics and in one considerable series showed less than 10 per cent.

It seems to be higher in infancy and after ten years than between these periods.

Prognosis of extent of damage. This is difficult to determine in the acute stage, for as has been said, what seems like an extensive damage involving trunk muscles may clear up entirely or the apparent damage may persist and spread and in rare cases the lesion may light up again after subsidence of acute manifestations.

Muscles which contract at all after the acute symptoms subside hold out hope of recovery in part or whole and efforts to improve the power of such muscles should be persisted in for many, many months.

A single muscle in a group functionating in common is more likely to recover than when associated in its paralysis with more members of the group or the group as a whole, in its paralysis.

SUMMARY

Isolation.

Of "contacts" for three weeks.
  Use of mild antiseptic sprays for the nose and throat by "contacts," e.g., 1 per cent. official peroxide of hydrogen.
  Look for abortive and ambulatory cases. (See text.)
Of patients.
  (See summary of Scarlet Fever, Chap. IX.)

Disinfection of patient's room.

(See summary of Typhoid Fever, Chap. V.)

Doctors and Nurses.

(See summary, Scarlet Fever, Chap. IX.)

Room.

High and well ventilated.
Near bath room.
Strip of furniture and furnishings.
Screen.

Bed.

Half or three quarters. Hospital type preferred.
Woven wire springs; firm mattress.

Care of body.

Cleansing baths of soap and warm water.
Sterile talcum powders.
Mouth.
  (See Pneumonia summary, Chap. IV.)
  Burn secretions. They contain the virus. Nurse should wear gloves in handling them.

Diet.

Acute stage.
  Milk, milk preparations, cereals, bread, broths thickened with cereal or farinaceous flours, eggs, custard, rice, ice-cream.
  Water, fruit juice drinks, such as lemonade, orangeade.
  May fortify with sugar.

- After acute stage.
  - Liberal diet. Satisfy appetite.

Treatment of symptoms.

- Rest, of body and especially the limbs and muscles impaired; the latter until all hyperæsthesia has disappeared.
- Do not urge patient to move muscles.
- Do not massage. } During the acute stage.
- Do not use electricity.

Bowels.

- Castor oil ʒii–℥i (8–30 c.c.).
- Salts (Epsom, Rochelle) ʒi–℥i (4–30 Gm).
- Calomel, gr. i to gr. ii (0.060–0.120 Gm),
- followed by salts.
- All these in dose according to age.
- Later.
  - Cascara, compound licorice powder, aloin, liquor magnesii citratis, milk of magnesia, Hunyadi water; dose according to age.
  - Occasionally stronger salts or castor oil.
  - Enemata. Required especially when abdominal muscles are paretic.

Urine.

- Watch for retention.
- Try running water.
- Sprinkle water on hypogastrium.
- Heat to bladder.
- Cold over bladder.
- Catheterize.

Preparalytic period.

- Fever.
  - Rarely requires attention.
  - Luke-warm water sponges.
- Hyperæsthesia, pain, sensitiveness of muscles.
  - Remove weight of bedclothes, by cradles and similar devices.
  - Light splints to painful limbs.
- Heat.
  - Fomentations.
  - Hot water bag.
  - Wrap part in thick layer of cotton batten.
- Drugs.
  - Bromides, especially when there is much irritability, gr. v to gr. xv (0.35–1.0 Gm) three or four times a day, according to age.
  - Phenacetin, gr. iss to gr. xv (0.1–1.0 Gm), according to age.
  - Antipyrin, gr. i to gr. x (0.060–0.65 Gm), according to age.
  - Acetanilid, gr. ss to gr. v (0.030–0.35 Gm), according to age.
  - Lesser doses, say one-third, may be repeated at two, three or five hour intervals.
- Salicylates.
  - Sodium salicylate or aspirin.

gr. i to gr. xx (0.060–1.35 Gm), according to age.
These doses may be repeated at two, three or four hour intervals if pain continues.
Codeine.
For more severe pain.
gr. $\frac{1}{48}$ to gr. $\frac{1}{4}$ (0.0015–0.015 Gm), according to age.
Morphine in most severe cases.
gr. $\frac{1}{120}$ to gr. $\frac{1}{4}$ (0.0005–0.015 Gm), according to age.
Insomnia.
Bromides, gr. v to gr. xxx (0.35–2 Gm), according to age.
Trional, gr. i to gr. x (0.060–0.65 Gm), according to age.
Codeine sulphate or phosphate, gr. $\frac{1}{48}$ to gr. $\frac{1}{4}$ (0.0015–0.015 Gm), according to age.
Stiffness and pain in muscles of the neck.
Heat.
Fomentations.
Convulsions.
Rare.
Warm packs.
Morphine to control, gr. $\frac{1}{48}$ to gr. $\frac{1}{4}$ (0.0015–0.015 Gm), according to age.
Bromides to prevent occurrence, gr. v to gr. xv (0.35–1.0 Gm) every three to four hours.
Gastro-intestinal.
Vomiting.
Stop food.
Sodium bicarbonate, gr. v to gr. xv (0.35–1.0) in water.
Bismuth subnitrate or subcarbonate, gr. v to gr. xv (0.35–1.0 Gm) suspended in water.
Diarrhea.
Regulate food, cut down cream and sugar in milk.
Give castor oil ʒii–℥ss (8–15 c.c.).
Follow with
Bismuth subnitrate, gr. xv to gr. xxx (1–2 Gm) every two hours.
Tonsillitis and pharyngitis.
Hot saline irrigations, argyrol 15 per cent. to 20 per cent.
(See summary in Scarlet Fever, Chap. IX.)
Urotropin.
(See text.)

Paralytic period.

Rest to paralyzed limbs.
Avoiding contractions.
Gentle stretching of muscles.
Rest at bottom of bed for soles of feet in drop of foot.
A box covered with a blanket sufficient.
Take weight of clothes from paralyzed parts with cradles and similar devices.
Light splints to correct position.
Pillows, folded blankets, for same purpose.
Change position of joint from time to time.

- Bulbar type.
  - Muscles of deglutition involved.
  - Keep mouth free from secretions and food particles.
  - May have to feed with stomach or nasal tube.
- Involvement of respiratory muscles.
- Dyspnœa.
  - Oxygen inhalations.
  - Atropine sulphate hypodermically, gr. 1/1000 to gr. 1/60 (0.00006–0.001 Gm), according to age.
  - Caffeine salicylate or benzoate, gr. 1/4 to gr. v (0.015–0.35 Gm) or
  - Strychnine gr. 1/500 to gr. 1/30 (0.00012–0.002 Gm) hypodermically, according to age.
- Artificial respiration.

Paralysis of extremities.

- After acute stage subsides.
  - Massage.
    - Gentle at first for very short time. Increase up to 15–20 minutes two or three times a day.
- Heat.
  - Fomentations.
  - Baking.
- Electricity.
  - Galvanism to nerve trunks.
  - Faradism to muscles that respond.
- Passive movements.
  - To prevent contractions.
  - To improve circulation in affected structures.
- Active movements.
  - Best method to develop impaired centers and muscles.
  - Keynote of success is persistency.
  - Warm bath a valuable adjuvant. (See text.)
- Resistance exercises.
- Apparatus.
  - Crutches, corsets, jackets, braces, splints.
- Operative treatment.
  - Transplantation of tendons.
- Arthrodesis.
- Silk ligaments.
- Operation for contractures.

Prophylaxis.

- Avoidance of contacts.
- Isolation of patient.
- Destruction of secretions.
- Members of affected families to avoid contact with children and crowded places.
- Children to avoid gatherings of children during an epidemic. Schools are common centers of the spread of the disease.
- Avoid taking children to affected localities, especially in summer.

Disinfection.

Dust of affected room has been shown to contain the virus (Thro). Disinfect the room.

(See Scarlet Fever, Chap. IX.)

CHAPTER XIX

SMALL POX

(VARIOLA)

SMALL POX still jealously guards the secret of its origin. A parasite, the Cytorrhyctes variolæ, first described by Councilman, bids fair, however, to elucidate the mystery. And yet, many of the symptoms of the disease must be attributed to the concomitant action of pyogenic organisms and in all probability it is to these that most of the fatal issues are due.

Jenner's observation that individuals who had suffered from cow pox became by virtue of that fact protected from small pox and his application of that knowledge in terms of vaccination constitutes one of the most dramatic episodes in medical history and is too familiar to want reiteration here. Jenner furnished the means of eliminating the disease forever and only ignorance and criminal carelessness or wilful neglect has prevented the passing of what once was a scourge to the human race.

There seems to be among physicians a wide-spread belief that the infectious organism or virus may be conveyed through the air as well as by contact, which makes isolation more imperative and more difficult; but so good an authority as Rosenau doubts any other mode of conveyance than a direct one, through discharges, secretions or objects, including insects, in contact with such.

In any case efficient treatment begins with **isolation** as soon as the diagnosis is made or even suspected.

Hospital treatment of the patient is preferable both from his standpoint and that of the community, but if the treatment must be carried out in the home, the physician must realize that a greater obligation rests upon him to establish and maintain isolation and teach the family their part in carrying it out. Skillful nurses can hardly be dispensed with.

Room. The room should be as remote from the rest of the household as possible with a separate approach from the outside to avoid unnecessary contact of nurses and attendants with other parts of the house or members of the family. It should be light, well ventilated, kept at 65° F. to 70° F. and screened against insects, whose access to the discharges and secretions affords a highly probable mode of conveyance.

The room should be stripped of all unnecessary furnishings and its treatment and separation from the rest of the house carried out as in Scarlet Fever, see Chap. IX.

Ready approach to a bath-room, itself under isolation, facilitates the work about the patient. An open hearth, making possible destruction of discharges on the spot by fire, is a desideratum. The discharges should always be burned. Rules for disinfection of bedding, towels, bed-clothes, utensils, etc., may be found under Typhoid Fever, Chap. V, and be considered as applicable here.

Nurses. If the nurse has not had the disease, she or he should be vaccinated afresh. The nurse should consider herself as isolated, so far as compatible with her duties. A separate kitchen should be afforded her and, if this is not possible, all dishes and utensils should be treated like those used by the patient. If she goes out at all she should take every precaution not to convey the disease and follow the rules laid down for a nurse attending a Scarlet Fever case. See Chap. IX.

Treatment of Other Members of the Family or Exposed Individuals. These should all be vaccinated with virus from more than one source to insure a "take." It is certainly desirable to quarantine those exposed, but not always possible. Those who show a successful vaccination may be released when this is obvious; others kept in quarantine for six to eighteen days; but if this is not possible they should be kept under the closest surveillance for the incubation period of sixteen to eighteen days, and isolated on the slightest suspicion of infection.

The apartments vacated by a small pox case must be thoroughly disinfected (see Summary) together with their clothes, toilet articles, utensils, tools or articles with which they may have come in contact since their infection.

Physicians should look upon themselves as potential sources of danger to the community. Except in emergencies they should make their visit to the patient the last one in the day and in any case spend some time in the open air before calling on another patient. They should take every precaution on the occasion of a visit to avoid contamination, should make their visit no longer than is necessary to do their full duty to the patient and then disinfect themselves as thoroughly as possible on leaving. For full details of precautions to be observed by the physician on his visit, see Scarlet Fever, Chap. IX.

Visitors should not be allowed unless circumstances arise that make it imperative and then should observe all those precautions specified for the physician.

Bed. The best bed is of the hospital type, an iron half or three quarters bed with woven wire spring and a firm mattress. For the details of bed-making, see Chap. IV.

In very severe cases, especially with skin complications such as boils, abscesses, bed-sores, an air bed or water bed may add greatly to the patient's comfort.

Diet. With the onset there may be decided anorexia and during this period no effort should be made to force the feeding. The diet should be preferably milk or milk preparations or if patients cannot take milk, and the vast majority of those who say they cannot are found to bear it well on trial, one may use cereal waters, cereal "prepared foods" used extensively in infant feeding, then broths fortified with cereals or farinaceous flours and egg albumin water. Later, however, consideration must be had for the theoretical demands of the patient and a fairly high caloric diet may be aimed at. The rules laid down in Typhoid Fever, Chap. V, are applicable here. The condition of the mouth in Small Pox makes the ingestion of food more difficult than in Typhoid and the patient must not be nagged and fatigued to ingest definite quantities fixed upon by these theoretical considerations.

Water should be given in abundance. Definite orders should be given the nurse not only to supply the patient's demands but considering the sicker patients too sick to appreciate their needs or to ask for water to offer it to them every hour when awake.

Fruit drinks, lemonade, orangeade, etc., may be used and afford an excellent vehicle to carry sugar, the food value of which contributes materially to the patient's needs.

Alkaline waters, such as Vichy or carbonated waters, if grateful, may be used.

Care of the Body. One has but to visualize the lesson to realize the great discomfort the patient must suffer and the amount of nursing skill and fidelity required to contribute to his comfort.

Mouth. During the pre-eruptive period the mouth should receive the attention usually given it in acute infections.

It should be rinsed after each feeding with water and then with 2 per cent. boric acid solution or half to quarter strength Dobell's solution or the equivalent in one of the many milder antiseptics on the market, the use of which may be more grateful to the patient. The teeth may be cleansed with a very soft brush and a good tooth paste or with a cotton swab on a toothpick saturated with one of the above solutions, particular care being taken to free from food the interstices of the teeth and the dead spaces between the gums and cheek. Dry coating on the tongue may be softened by half strength official peroxide of hydrogen and scraped with edge of a whalebone. When, however, the eruption appears, the painful vesicles in the mouth and throat add much to the difficulty of affording proper care. No harsh instrument such as the tooth-brush or whalebone can be used. The same solution may be used but irrigations will afford comfort; indeed, much the same measures may be used as in Scarlet Fever. (See Chap. IX.)

When the mouth is foul, permanganate of potash, a claret colored solution, 1 to 4,000, may be used as an irrigation or this may be preceded by half strength peroxide of hydrogen. Chlorate of potash gargles may be used, 1 per cent., or less if painful. Ulcers may be touched with silver nitrate solution, 5 per cent. to 10 per cent. When the throat is painful, ice applied to the neck as in tonsillitis may afford relief.

Nose. The nose should be kept free from secretions, by the gentle use of such solutions as have been mentioned in the care of the mouth, as sprays and by cotton swabs, on wooden toothpicks as applicators, dipped in the same solutions. Dried secretions may be moistened first by the application of sweet oil or vaseline.

Eyes. The need of careful attention to the eyes cannot be too much emphasized. At the height of the eruption, it and the attendant œdema make proper care of the eyes no easy task.

Boric acid solution, 2 per cent. to 4 per cent., should be applied on wipes to keep the lids clean and be dropped in the eyes. When the eyes close from the œdema a warm boric acid solution must be used as an irrigation, the point of a glass irrigating nozzle being gently forced between the lids. To prevent the lids from sticking together an application may be made to their edges of vaseline or gr. i (0.06 Gm) of yellow oxide of mercury to ʒi (4 Gm) vaseline.

Frequent and prolonged applications of cold compresses dipped in a 2 per cent. to 4 per cent. boric acid solution or physiological salt solution tend to lessen the œdema and discomfort.

When the conjunctivitis is very severe, 5 to 20 per cent. argyrol solutions are useful applications.

When corneal ulcerations occur atropine should be used.

Skin. One can imagine the task imposed on the skill of the nurse and the ingenuity of the physician to keep the skin, the site of a multitude of pustules, hot, painful and itching, in even relative comfort. In the pre-eruptive period, sponge baths of soap and warm water are proper and desirable, but during the height of the eruption sponge bathing is no longer feasible. Some authors urge, however, the use of prolonged **warm baths**, keeping the patients immersed for hours at a time. It is claimed for these warm baths that they reduce the fever, lessen the nervous excitation, are a sedative to the skin and macerate the pustules, thus effecting an earlier discharge of their contents. Certainly the procedure seems a rational one and the criterion of its success is the response of the patient. The temperature of the water should be about 95° F. It is best carried out in a long bath-tub at the bed side with a comfortable hammock arrangement attached to the sides of the tub to suspend the patient and facilitate moving him.

Burning and Itching. This may be delayed by prolonged warm baths at 95° F. or the efficacy of the baths may be enhanced by the addition of carbonate of soda, 2 to 10 ounces of soda to a bath-tub of water (30 gallons).

As the itching and burning is most intense in the face and hands, cold compresses may be applied to them with comfort. Hot compresses, especially to the extremities, are sometimes found more grateful.

Rührah has mentioned the efficacy of alum solutions 1 per cent. to 2 per cent., or baths in a 1 to 1,000 solution (1 pound of the alum in a bath tub of 500 liters.)

When watery solutions are not applied oily substances find favor, for they both alleviate the discomforts and keep the pustules soft and facilitate their discharge. Opening these pustules to relieve the patient of the effects of absorption from them appeals to me. Of course, all applications must be frequently changed, especially in the pustular stage, as the dressings soon become drenched with discharges.

Ointments are especially applicable when the crusts begin to form.

Simple vaseline or sweet oil may be used or the same on dressings but the itching is more quickly ameliorated if 3 per cent. to 5 per cent. carbolic is added to the one or the other.

Some clinicians advocate glycerin one part to two of water as an excellent application.

The itching is sometimes intolerable; yielding to it lacerates the skin and invites such secondary infections as abscesses and erysipelas. In children mechanical restraint may be necessary to prevent the scratching, such as splints at the elbows and thick "boxing-glove" like bandages to the hands. Innumerable applications have been advocated, their very number declaring the difficulty of the problem. Hubbard uses on the face white precipitate ointment applied on a linen mask. Appreciating the possibility of absorption he changes occasionally to ordinary zinc oxide ointment. He also uses cold watery solutions of glycerin ʒi to ℥i (4–30 c.c.) applied on absorbent cotton.

Rührah advocates spraying with alcohol to relieve the itching and sometimes adds ½ per cent. to 1 per cent. menthol to this. He further speaks of the value of spraying with carbolic acid (phenol) in water solution 1 to 40.

Schamberg advocates warmly the use of undiluted tincture of iodine. He begins this early and applies it to the face once or twice a day, if the skin is not too sensitive. In some cases a dilution of one-half may be used. He claims not only increased comfort under the application but a modification in the severity of the eruption, a decrease in the secondary infections and a relief from offensive odors. (*Practical Treatment,* Musser and Kelly.)

If the face becomes dry and uncomfortable under the treatment, they apply such ointments as cold cream. Powders, too, have been used to allay the itching. Hubbard (Hare's *Modern Treatment*) speaks highly of one made of equal parts of boric acid, lycopodium, corn-starch and subgallate of bismuth. He applies this freely.

The offensive odor demands the physician's attention.

The application of iodine lessens this.

Schamberg uses iodoform 2 parts, boric acid 10 parts, and talcum 28 parts, dusting it on freely after a bath.

Aristol may be used instead of iodoform.

To Separate the Scabs. Warm sponge or tub baths facilitate the separation as do ointments or plain vaseline.

Care of the Skin. When the scabs fall off the skin is often very tender and the application of bland and sterile toilet powders are grateful.

Complications such as furuncles, abscesses and erysipelas are to be treated on surgical principles.

If the head is shaved at the beginning of the disease local treatment of the eruption on the scalp will be greatly facilitated.

SYMPTOMATIC TREATMENT

Bowels. When first seen the patient should be given an initial catharsis of salts, Rochelle, Epsom, or Glauber's, ℥ss–i (15–30 Gm) in three-fourths glass of water or this may be preceded by calomel in divided doses gr. ¼ (0.015 Gm) every quarter hour for six doses and two to three hours later followed by the salts.

Later the bowels should be moved daily or every other day by enemata or milder salines, such as Hunyadi water, milk of magnesia or one of the milder salines on the market.

The initial stage, which marks the period between the onset and the eruption, usually lasts three days. It is rife with discomforts. The onset is sudden and characterized by the severity of pains in the head and back, the nervous manifestations of the toxæmia and the fever.

A chill usually precedes the febrile impulse, but requires no especial consideration.

The **fever** as a rule is maintained during the initial stage at about 104° F. Such a degree of temperature requires no interference. Cool sponges, however, afford the patient comfort.

At the end of the initial stage the temperature goes down to normal or to but a little above and stays down until the stage of suppuration, when it goes up again.

Excessive high temperatures are best controlled by the cold pack or prolonged tepid baths at 95° F.

Headache is severe, often intense. It is best treated by the application of the **ice-bag** or **ice coil.**

In the early stages, the sthenic period of the fever, small doses of **phenacetin,** gr. iii to gr. v (0.2–0.3 Gm) at half-hour intervals for three or four doses, or acetanilid in doses of gr. iss to gr. ii (0.10–0.120 Gm) at the same intervals for three or four doses may be safely administered if the patient has not cardiac trouble. Later when the circulatory apparatus has felt the effects of the toxins of the disease all members of the coal-tar series should be avoided, because they are themselves depressing.

If the headaches are agonizing, as they sometimes are, morphine may be imperative.

The same drugs may be used to relieve the backaches.

Delirium, may occur in the initial stage, but is more common and violent in the suppurative stage. Fresh air and the ice-bag applied to the head may give some measure of relief. Prolonged tepid baths are probably more efficacious.

The patients must be very carefully guarded lest they leave the bed and do themselves harm. Sometimes mechanical restraint is necessary. Sheets drawn fairly snugly and firmly secured with the hands held under them is the most humane method.

If delirium becomes so decided as to require drugs, morphine is the best to use, in doses of gr. 1/8 to gr. 1/4 (0.008–0.015 Gm) hypodermically and this may have to be given three times in the day.

Insomnia, when continued night after night becomes a serious consideration, as it takes a mighty toll of the patient's strength. Well ventilated rooms, good nursing, enough water to drink, all conduce to good sleep. The ice-bag is a help, the prolonged warm baths contribute; but in spite of these measures drug assistance may be needed. The mild hypnotics may be tried at first, such as trional gr. x to gr. xx (0.65–1.30 Gm) in a little whiskey or in powder form, washed down with water, or in a little warm fluid like barley water or milk; or chloralamid may be used, gr. xv to gr. xxx (1–2 Gm) in whiskey or as a powder, but not in warm menstrua, which decompose it.

Either of these drugs may be repeated in the same dose in two or three hours if necessary.

Bromides in doses of gr. xxx (2 Gm) may be given in the early evening or this dose may be given in the late afternoon and repeated in the evening. One may use the potassium salt or the mixed or "triple" bromides, potassium, sodium and ammonium gr. x (0.65 Gm) each. Administer in water. Chloral in gr. x doses (0.65 Gm) may be tried in the initial stage. It is given in water or dilute whiskey, brandy or wine. It should not be given later when the centers are depressed.

Too many attempts with these milder hypnotics should not be made to the sacrifice of the patient's strength, but morphine should be used in doses of gr. 1/8 to gr. 1/4 (0.008–0.015 Gm) hypodermically.

Gastro-intestinal symptoms are not striking, but there may be nausea and vomiting at the onset. This rarely requires treatment, but if retching continues copious draughts of warm water may afford relief or small doses of sodium bicarbonate gr. x to gr. xx (0.65–1.20 Gm) or bismuth subnitrate gr. x to gr. xv (0.65–1 Gm).

Respiratory Symptoms. There may be some **laryngitis** and this is best treated by inhalations of steam or medicated steam, using compound tincture of benzoin, oil of eucalyptus, menthol or oil of pine; but the effort to inhale and the discomfort of the heat attending the administration may outweigh the benefit accruing to their use.

Some **bronchial involvement** is common, if not constant. In some cases **bronchopneumonia** may occur. For the treatment of these conditions, so far as the eruption will permit, see Pneumonia, Chap. IV.

Œdema of the glottis is a much severer complication and should this intervene demands intubation (see Diphtheria, Chap. X) or tracheotomy.

Circulation. When evidences of a failing circulation occur, all those measures applicable to the same condition in other acute infections are indicated. For detail, see Pneumonia, Chap. IV.

Release from Quarantine. This should be permitted only when the desquamation is completed, and this occurs last in the thick skin of the hands and feet. Warm baths and the use of soap facilitates the desquamation. Sweet oil or vaseline softens the dry skin and hastens its separation.

Finally the patient should have an antiseptic bath of 1 to 10,000 bichloride after a thorough soap and water bath and a shampoo.

He should then be removed to a clean room and given clean clothes or his old clothes only after a thorough disinfection.

Disinfection. All those articles that have come in contact with the patient and which can readily be spared should be burned when possible.

Such articles as clothing, bedding, mattresses, carpets, should be disinfected by superheated steam. If this is not possible, mattresses and pillows had better be burned, washable bedding boiled thoroughly and carpets be submitted to the disinfecting vapors used to disinfect the room.

Formaldehyde vapor gas is the best as it is not injurious to any fabric or color. Sulphur dioxide is also efficacious but its injurious effects on metals and fabrics must be remembered.

For details of disinfection, see Scarlet Fever, Chap. IX.

The dead should be cremated or the body wrapped in sheets saturated in strong antiseptics and buried deep.

VACCINATION

That after more than one hundred years of the beneficent results of vaccination there should still be found bitter opponents to the procedure, forces us to accept them as psychological aberrants, in no way amenable to facts or reason.

Were vaccination universally and properly carried out there would be no small pox to treat, for the sporadic case and the poorly protected community that furnish the factors necessary for an epidemic would cease to exist and a disease whose mortality is 45 per cent. to 50 per cent. and in individual epidemics even higher would become of historic interest only.

Time for Vaccination. The first vaccination should be in early infancy. Before the fifth month the reaction is less than later. As an accoucheur it was my custom to vaccinate the infant before the lying-in period was completed.

The results were most satisfactory both with reference to the character of the "takes" and the absence of constitutional reactions. **Revaccination** should be done between the ages of ten and fourteen and again and as often as the individual is directly exposed or an epidemic prevails in his community, unless a previous vaccination dates back to only one or two years.

Vaccination or revaccination is to be insisted on in every member of the patient's family exposed and revaccination should be practiced by the physician and nurse on the occasion of every small pox patient seen, unless the interval is less than a year. A failure to "take" on revaccination may be due to many other causes than lack of susceptibility, so that in case of marked exposure, a surety of technique and freshness and activity of virus must be had and a repetition of the inoculation is the better part of wisdom.

The average **period of protection** is usually accepted as seven years, but this period must not be accepted as an excuse for not revaccinating after exposure.

All persons who have been exposed should be revaccinated, nor should the length of time after exposure enter into the question of whether the exposed individual should be revaccinated or not, for even if the protection afforded be not complete it may be relatively so. Early in the incubation period a vaccination will prevent the disease. In these cases the typical vaccination pustule has time to develop before the febrile period is due. In the middle of the incubation period vaccination will serve to modify the severity of the disease; late it will have no effect.

Previous vaccinations enhance the efficiency of the last done during the incubation period. This period is ten to twelve days.

Technique. The virus must be active and secured from recognized sources.

Virus furnished in capillary tubes, each a single inoculation, is preferable to the dried virus on points. If kept, it must be kept cold, as high temperature destroys it or lessens its strength.

The **site of inoculation** is best rendered clean by soap and water, best by green soap and boiled water, and this followed by alcohol. When dried it is ready for the inoculation. The site preferred is the arm, usually the left, at the insertion of the deltoid. The resulting scar, which in a woman is deemed undesirable at this site, may lead one to choose the leg. The place commonly chosen is on outer aspect of the leg (not thigh) just below the head of the fibula.

The **inoculation.** A slight wound is made at the chosen site. Some prefer scraping with the edge of a scalpel, others a scarification by cross-hatching, and others incisions. Incisions are insisted on in Germany and recommended in England. They are made with the edge of a scalpel or point of a needle in Germany, 1 cm. long and 2 cm. apart, 4 in number.

I prefer a small cross hatch of about 1/8 inch square made with a needle sterilized in a flame. If there has been exposure three or four of these 3/4 inch apart.

Blood should not be drawn by any method to a greater extent than to produce bloody serum. The virus is then applied to the abrasion and rubbed gently in with a sterile needle, using the eye-end or a sterile wooden tooth-pick, using the blunt end. The serum and virus is then allowed to dry in the air. The only **protection** necessary is several layers of clean gauze sewed into the sleeve of the undervest, drawers-leg or stocking over the site of the inoculation. Once thoroughly dry, a folded clean handkerchief may be used. If the child can not be trusted to avoid scratching, this gauze should be secured to the part by adhesive strapping, but should be loose over the inoculation.

Shields, pads and other protective contrivances do very much more harm than good.

After the first day bathing, including the site of the inoculation, need not be avoided.

If the vesicle ruptures it is to be cleansed with saturated boric acid solution and 10 per cent. boric acid ointment (made with vaseline) may be applied.

If it becomes infected it is to be treated exactly like any infected wound, on surgical principles.

If the vaccination "takes," on the third or fourth day a papule appears, and on the fourth or fifth day a vesicle, showing an infiltration.

The vesicle becomes mature on the seventh, shows the pustule on the eighth with a second umbilication. An areola has formed about the developing vesicle and on the ninth day this begins to fade, on the eleventh or twelfth day the scab forms and slowly separates in the third or fourth week, leaving a pit which heals with a scar showing the characteristic pits or foveations which are the sign of a successful vaccination.

General Symptoms. With the appearance of the vesicle and during its development there may be, but not necessarily, a febrile reaction with attendant discomforts such as headache, backache, etc., simulating a mild attack of grip. The part inoculated may itch or burn or a considerable inflammatory reaction with a resulting sore arm may ensue.

The regional lymph glands are usually swollen and often tender.

Immunity is established about the time of the pustule formation, on the eighth day.

Complications of Vaccinations. These are percentually small, but in one or other form must be met by every active practitioner. The most common result from infection of the wound by pyogenic organisms.

All too frequently one sees deep and broad ulcerations; less commonly, abscesses, cellulitis, lymphangitis, phlebitis, suppurating glands, gangrene, erysipelas and pyæmia. As a less serious complication we see occasionally an impetigo contagiosa. When one considers the careless and often filthy habits of many who are compulsorily vaccinated, the numbers of serious infections seem incredibly small.

These complications are nearly all surgical problems and to be treated on surgical principles.

Another serious but fortunately rare complication, which from its dramatic course always attracts public attention, is **Tetanus.**

It is true that this unfortunate infection, which has been traced more than once to the virus (and then several such cases, directly traceable to the same supply of virus), does occur; but I am convinced that in the vast majority of instances and in all sporadic cases it is due to infection of the wound by the patient.

A case seen recently by me in consultation was such an one, for no other case from this virus had been reported to the Board of Health and the technique of the practitioner was irreproachable. The child was saved by prompt intraspinal administration of tetanus antitoxin. (See Tetanus, Chap. XXXII.)

Generalized vaccinia occasionally occurs as a result of vaccination.

It appears usually during the development of the vesicle to a pustule, comes out in crops and may last some time, in rare instances three to four weeks.

The same thing may occur as the result of auto-inoculation. This is due to conveyance of the virus from the ruptured pustule to other slight abrasions on the body, most commonly by scratching.

Contra-indications. During illness or if recently exposed to the exanthemata; if there is any suppurative process in the body or of the skin; in illy nourished infants or in adults suffering from severe constitutional or organic disease. It is contra-indicated in bleeders for obvious reasons.

It is better not to vaccinate during menstruation, unless the need is urgent.

Revaccination. The course is not always the same as in the first vaccination.

It may be in those cases in whom the immunity has disappeared; but those in whom a partial immunity persists, an anaphylactic state or "allergie" show what the students of anaphylaxis entitle "an accelerated reaction"; that is, a shortened incubation period and pustule formation (the sixth day) or "an immediate reaction" with an incubation period of less than twenty-four hours and the formation of a papule or erythematous halo about the site of the inoculation, the equivalent of the now familiar Von Pirquet's tubercular reaction.

Conviction, vision, courage, persistency in advocacy, were all needed to establish this amazing contribution to human welfare one hundred years before the birth of immunilogical studies and all these were found in Jenner.

SUMMARY

Isolation.

Hospital treatment preferred.
Home treatment.

Room.

For choice and treatment of room, see Scarlet Fever, Chap. IX.
Disinfection during illness of discharges, clothes, objects, see Typhoid Fever, Chap. V.

Nurses.

Should be revaccinated.
Isolated from rest of household.
(See Scarlet Fever, Chap. IX.)

Treatment of other members of the family or exposed individuals.

Vaccinate with a virus from more than one source.
Quarantine if possible.
Release when vaccination is successful.
If vaccination does not "take" quarantine or keep under closest observation sixteen to eighteen days.

Physicians.

Revaccinate.
Make case last call of day if possible.
Stay only long enough to fulfil duties.
Do not call on a susceptible person at once, but keep in open air for a time.
For rules of visit and disinfection on leaving see Scarlet Fever, Chap. IX.

Bed.

For choice and technique of making bed see Chap. IV.

Diet.

- Don't force during early stages when there is much anorexia; milk, milk preparations, cereal waters, cereal foods (infant foods), broths fortified with cereals or farinaceous flours, egg albumin.
- Later, try to approximate food needs. (See Typhoid Fever, Chap. V.) Condition of mouth makes it difficult.
- Water, offer freely, every hour.
  - Fruit drinks, lemonade, orangeade, etc., fortified with sugar.
- Alkaline waters.

Care of the body.

- Mouth.
  - Pre-eruptive period.
    - Rinse after each feeding with water, then with
    - Boric acid solution 2 per cent. to 4 per cent. or
    - Dobell's solution half to quarter strength.
  - Teeth cleansed with soft tooth-brush and good paste or with cotton swabs on wooden tooth-picks, wet with above solution.
  - Free interstices of teeth and dead spaces between cheeks and gums from food.
  - Soften coating on tongue with half strength official peroxide of hydrogen. Scrape with edge of whalebone.
  - Eruptive period.
    - Can not use tooth-brush or whalebone.
    - Irrigations of above solutions.
    - When mouth is foul.
      - Permanganate of potash solution, claret colored (1–4,000).
      - Chlorate of potash gargles 1 per cent. or less.
  - Ulcers.
    - Touch with silver nitrate solution 5 per cent. to 10 per cent.
- Nose.
  - Dried secretions softened with sweet oil or vaseline.
  - Cleansed with above solutions applied with swabs on tooth-picks or as
  - Sprays.
- Eyes.
  - Cleansed with 2 per cent. to 4 per cent. boric acid solution.
  - When closed with œdema
    - Gentle irrigation of conjunctival sacks with warm boric acid solutions 2 per cent. to 4 per cent.
    - Cold compresses of boric acid solution, frequent and prolonged.
    - Prevent lids sticking by applying vaseline to edges or 1 part of yellow oxide of mercury to 60 of vaseline.
  - Severe conjunctivitis.
    - Five per cent. to 20 per cent. argyrol solution once or twice a day.
  - Corneal ulcerations.
    - Apply atropine solution.
- Skin.
  - Pre-eruptive period.
    - Sponge baths of soap and warm water.

- Eruptive period.
  - Prolonged warm baths, at 95° F. in tub.
- Burning and itching.
  - Warm baths at 95° F.
  - Bicarbonate of soda may be added to the bath.
  - Cold compresses.
  - Alum solutions 1 per cent. to 2 per cent.
  - Alum baths 1 to 1,000 solution. } Rührah.
  - Simple vaseline.
  - Sweet oil.
  - Three per cent. to 5 per cent. phenol in oil or vaseline.
  - Glycerin 33 per cent. solution in water.
- To prevent scratching in children.
  - Mechanical appliances.
  - Splints to elbows.
  - Bandages to hands.
- (For other appliances, see text.)
  - Cold cream.
- Powders.
  - Sterile toilet powders.

℞

Boric acid,
Lycopodium,
Corn starch.
Subgallate of Bismuth, equal parts. } Hubbard.

- Offensive odors.

℞

Iodoform,	2 parts,	} Schamberg.
Boric acid,	10 parts,	
Talcum,	28 parts.	

- Aristol.
- To separate scabs.
  - Warm baths.
  - Vaseline.
  - Apply sterile toilet powders to tender skin after scabs fall off.
- Furuncles,
- Abscesses,
- Erysipelas. } Apply surgical principles.

Symptomatic treatment.

- Bowels.
  - Calomel gr. 1/4 (0.015 Gm) every quarter hour for four doses, then in two hours
  - Salts, Epsom, Rochelle or Glauber's ℥ss to i (15–30 Gm) or salts alone.
  - Later.
    - Milder salines.
    - Milk of magnesia.
    - Citrate of magnesia.

        - Hunyadi water or
        - Enemata.
- Fever.
    - Cool sponges.
    - Prolonged warm baths at 95° F.
    - Excessive fever.
        - Cold packs.
- Headache.
    - Ice bag or ice coil.
    - Early stages.
        - Phenacetin gr. iii to gr. v (0.20–0.30 Gm) every half hour for three to four doses.
        - Acetanilid gr. iss to gr. ii (0.10–0.12 Gm) at same intervals.
        - Do not use these when circulation is depressed.
    - When annoying.
        - Morphine gr. 1/12 to gr. 1/4 (0.005–0.015 Gm).
- Backache.
    - Same drugs as for headache.
- Delirium.
    - Fresh air.
    - Ice-bag.
    - Prolonged warm baths at 95° F.
    - Mechanical restraint, best with tightly drawn sheets.
    - Morphine, hypodermically, gr. 1/8 to gr. 1/4 (0.008–0.015 Gm).
- Insomnia.
    - Air.
    - Ice-bag to head.
    - Prolonged warm baths at 95° F.
    - Trional gr. x to gr. xx (0.65–1.30 Gm) in whiskey or in powder. May repeat in two hours if needed.
    - Chloralamid gr. xv to gr. xxx (1–2 Gm) in whiskey or in powder. (Do not give in warm drink.) May repeat in two hours.
    - Bromides gr. xxx in evening or late afternoon and repeat in evening, either potassium bromide or the mixed, ''triple,'' bromides of potassium, sodium and ammonium.
    - Chloral gr. x (0.65 Gm) in water, whiskey or wine. Do not use except in sthenic period.
    - Morphine hypodermically gr. 1/8 to gr. 1/4 (0.008–0.015 Gm).
    - Gastro-intestinal symptoms. Not marked. (See text.)

Respiratory symptoms.

- Laryngitis.
    - Inhalations of steam, plain or medicated with
    - Compound tincture of benzoin.
    - Oil of eucalyptus.
    - Oil of pine, a teaspoonful or two in the hot water, or
    - Menthol, a few drops of saturated alcoholic solution in the hot water of the inhaler.
    - Cold compresses to neck.

Bronchopneumonia.

(See Pneumonia, Chap. IV.)

Œdema of glottis.

Intubation. (See Diphtheria, Chap. X.)
Tracheotomy.

Circulation.

(See Pneumonia, Chap. IV.)

Release from quarantine.

When desquamation is complete.
Soap and water bath and shampoo, then
Give antiseptic bath of 1-10,000 bichloride of mercury.
Remove to clean room and put on clean clothes.

Disinfection.

(See Scarlet Fever, Chap. IX.)

CHAPTER XX

TYPHUS FEVER

The infecting agent in typhus fever is unknown,[1] but the mode of conveyance has been recently discovered, thanks to the brilliant work of Nicolle and Conseil, Anderson and Goldberger, Ricketts and Wilder, and Gavino and Girard. To this work Ricketts yielded his life, a martyr.

Again, as in Malaria, an insect plays the rôle of the intermediary; this time the louse, **Pediculus vestimenti,** conveying the organism by its bite from the infected patient to a susceptible individual. This constitutes the most important contribution to our knowledge of the disease ever made and explains many observations on its epidemicity; its association with crowding, wretchedness, its "short striking distance," its prevalence in cold climates and in cold season, etc. It also renders precise efforts to prevent its spread or its occurrence.

In these latter years typhus fever had been considered a rarity in the Northern States. Recently a symptom complex which had many features in common with mild typhus fever was reported by Brill of New York. A considerable number of these cases was observed in New York, Chicago and other Northern cities, and, for a time, was considered as possibly a new disease. It has been shown, however, experimentally, that this disease is identical with Mexican and European Typhus and that it is conveyed by the same means. The incubation period of typhus lasts as a rule from eight to twelve days; exceptionally as short as four or as long as fourteen. The invasion is abrupt and the duration lasts from twelve days in a child to twenty-one to twenty-four in an adult. In the monkey the period has been observed to be twelve days.

The **onset** of the disease is rapid, characterized by the sharp rise of temperature which reaches its maximum on the second or third day and is accompanied by very severe headache. The characteristic eruption appears on the third to the fifth day, first on the abdomen, then on the chest, the shoulders, the back and the extremities. It takes two to three days to reach its full development and there are no second crops. Nervous manifestations, delirium or stupor and progressive and severe toxæmia are the striking features of the disease.

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[1] Addendum—The claims of Poltz to the discovery of a bacillus in the blood of Typhus Fever patients capable of producing the disease in animals seems likely to be substantiated.

TREATMENT

Isolation. The knowledge of the mode of conveyance makes our efforts at prevention of spread more successful than in the days when it was supposed to be conveyed by fomites or more mysterious agents. The key-note to prevention of the spread lies in the destruction of the body louse. The patient should have a room chosen with reference to an abundance of light and air and convenience for nursing. The clothes worn by the patient should either be destroyed by burning or the lice killed by immersion in boiling water or by standing in 1 to 500 bichloride of mercury. The hair should be clipped and the head given a thorough sponging with 1 to 2,000 bichloride of mercury. The hair on the pubes and in the axilla or in hairy individuals that on the chest, back or elsewhere should be shaven and mercurial ointment applied to these parts.

The body should be sponged with 1 to 2,000 bichloride of mercury, later washed with soap and water and again sponged with the bichloride solution.

If the head is not shaven but the hair merely clipped, the eggs may be loosened from the hair by soaking the head in vinegar overnight and wiping off the eggs with a towel wet with bichloride.

The choice of the bed and the manner of its preparation should be exactly the same as in Typhoid. (See Typhoid Fever, Chap. V.)

Care of the Patient. A cleansing bath of soap and warm water should be given daily. Late in the disease particular care should be given to prevent the formation of bed sores by turning the patient from one side to the other frequently, by rubbing the points of pressure, keeping the parts dry, and, when the parts show signs of pressure by persistent redness or bluish discoloration, using rings or cushions to lift the part off the bed. When bed sores form, if superficial, they are to be treated by scrupulous cleanliness and the utilization of some drying powder such as stearate of zinc, or zinc oxide, talcum and starch mixtures. If the sores are more extensive they should be treated on surgical principles and the utilization of a water bed or air bed may be necessary.

The mouth and nose should be treated as in other infections by keeping them clean with such mild antiseptics as boric acid solution 2 per cent. to 4 per cent. or some mild alkaline solution of which there are many on the market. This care should be exercised after every feeding and particular attention should be given to the removal of food particles from between the teeth and from the dead spaces in the mouth between the gums and teeth.

In the severe cases the mouth becomes very dry, the tongue heavily coated and sordes appears upon the teeth and lips.

The treatment will be found detailed in the article on Typhoid Fever (Chap. V).

Diet. Of prime importance is the administration of an abundance of water; a sufficiency of water diminishes dryness of the mouth, torpidity of the bowel and heightens the efficiency of the emunctories.

The mental condition of the patient is such that one should offer him water at frequent intervals, at least hourly, and not wait for expression of thirst on his part. All the water should be given that the patient will willingly take, and this may amount to three, four or more quarts a day. The administration of food is determined by the same physiological necessity as in any continued infection (see Diet in Acute Infectious Diseases, Chap. II), and the rules laid down for diet in Typhoid Fever hold for Typhus, except that it is to be remembered that the urgency for a high caloric diet is not so great because the infection runs a shorter course, and further, that the degree of toxæmia as a rule makes the feeding more difficult than in Typhoid Fever.

One may have to depend almost entirely upon liquids or semiliquid foods, such as are set forth in the Typhoid dietaries.

Fever. The fever is usually high and is sustained often at 104° F. to 105° F. throughout. Except in rare cases of hyperpyrexia the treatment directed at the fever is really directed at the toxæmia and its effects upon the circulation and respiration; hence, simple antipyretics, such as the coal tars, are contraindicated; first, because the fever, *per se,* is not a menace to the patient, but, except in hyperpyrexia, is rather a purposeful reaction of the body harboring toxic material; secondly, because these drugs are direct and potent depressants of the circulation.

The antipyretic measures, however, which are legitimate are those which are at the same time stimulating to the vital functions and are used because of this latter effect.

They are, first, the use of cold water, and one may have recourse to the same hydrotherapeutic measures as in Typhoid; the baths, the slushes, the packs, the sponges, with the same indications and contraindications as in Typhoid (for which see Typhoid Fever, Chap. V); second, open air. The preparation of the patient and his bed for open air treatment is identical with that of Pneumonia (see Pneumonia, Chap. IV), and, as in Pneumonia, the delirium of the patient necessitates the constant presence of nurse or attendant to prevent the patient from leaving his bed and doing himself some injury.

Circulation. Except in fulminating cases the circulation does not show the depressing effects of the toxin until the second week; then the rapid heart, the low blood pressure and the change in the quality of the heart sounds bespeak its depressing effects. One may use caffeine, camphor and later digitalis in the same manner as described for failing circulation in pneumonia (see Pneumonia).

It must be remembered, however, that more potent than these drugs are the effects of fresh air and cold water as described under Pneumonia.

Bowels. Early in the disease the intestine should be thoroughly evacuated by the use of Epsom or Rochelle salts in doses of 1/2 ounce to 1 ounce (15–30 Gm), or by Castor oil in the same dose or by calomel, grains 1 1/2 to 2 grains (0.10–0.12 Gm), followed in four hours by salts as above.

If there be nausea or vomiting, calomel is especially indicated but in divided doses, 1/4 grain (0.015 Gm) every quarter hour until six or eight doses are taken. Later the bowel is to be moved by an enema. In this disease constipation and meteorism occur not infrequently and when the circulation is embarrassed or the lung involved the latter constitutes a true danger. It is to be combated in the same manner as in Typhoid. (See Typhoid, Chap. V.)

Nervous Manifestations. These are particularly shown in the severe headaches, the delirium or the stupor. The headache is often intense and is best met by the use of the ice-cap; in the more violent headache morphine may be necessary.

Delirium and Headache. During the first half of the first week the mind is usually clear; then delirium or stupor intervenes; the delirium is violent and hallucinations of a terrifying character occur. The patient is peculiarly alert and requires continual watchfulness. The delirium increases during the development of the eruption. It is to be treated by the application of the ice bag to the head; in milder forms by bromides, 15 to 30 grains (1–2 Gm), three or four times a day; but in the severe types necessitates the use of morphine. Instead of delirium the patient may go into stupor and coma; all the nervous symptoms are likely to be less severe or are ameliorated by use of the **cold bath** or by treatment in the **open air,** but in the latter case some restraint and constant guarding are necessary.

The temperature as a rule subsides by rapid lysis occupying a couple of days. If the defervescence occupies a much longer period one should think of the possibilities of complications.

Convalescence. Convalescence is usually rapid; the diet is increased and the patient is allowed to sit up in bed, then in the chair, and then to walk around. These efforts are determined by the patient's returning strength and by evidences that the circulation has regained its strength as shown by no great increase in pulse rate when these efforts are made.

Complications. Laryngitis is fairly common and may be treated by inhalations of **steam,** or steam medicated with **compound tincture of benzoin, oil of pine,** or the **oil of eucalyptus,** a teaspoonful on the hot water in the croup kettle or a substitute for it in the shape of a pitcher or pail.

Œdema of the larynx sometimes occurs and may require intubation, tracheotomy or scarification. **Bronchitis** and **Pneumonia** as well as **Pleurisy** and **Empyema** can take place, and are to be treated as under other circumstances. Frequently turning the patient lessens the congestion that favors the onset of these complications.

Diarrhea. While constipation is the rule, diarrhea sometimes is seen. Profoundly toxic patients may suffer from incontinence. Proper care of the bowels from the start renders the onset less probable; it is to be treated by Bismuth in 30 grain (2 Gm) doses every two hours, or by small doses of castor oil, 10 minims (0.60 c.c.) every two hours, to which 1 minim (0.060 Gm) of the deodorized tincture of opium may be added with benefit. In either case it is well to administer a large dose of castor oil, ½ ounce to 1 ounce (15–30 c.c.), every second day.

Parotitis. This complication may result from neglect of the mouth. If mild, it requires no treatment or the application of an ice bag, but if suppuration follows it must be treated on surgical principles.

In some epidemics or in some individual cases, the disease may be so mild as to require little treatment other than good nursing; again it may be fulminating in character defying all effort, and resulting in death in three or four days. Relapses are exceedingly rare.

Disinfection. This consists in the destruction of the parasite, the louse, either by burning the clothing worn by the patient or by disinfecting it as described above. An assurance must be had that the patient's body is clean from the pediculi and the room must be disinfected by burning sulphur, either the sticks or the flowers, 5 pounds to each cubic foot, leaving the room closed twelve hours as is recommended by Anderson,[1] who says that formaldehyde is of doubtful value in the destruction of the parasite.

SUMMARY

Isolation.

The disease is conveyed by the body louse.
Clothes worn by patient should be burned or
Boiled or
Immersed in 1–500 bichloride of mercury.
Hair should be shaven from head.
Sponge head thoroughly in 1–2,000 bichloride of mercury.
Hair shaven from axilla, pubes and chest or elsewhere in hairy individuals.
Apply mercurial ointment to the parts shaven.
Sponge body with 1–2,000 bichloride, then

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[1] Anderson recommends 5 pounds per 1,000 cu. ft. as a germicide and 2 pounds per 1,000 cu. ft. as an insecticide.

Wash with soap and water and sponge again with bichloride.
If head is not shaven, but the hair only clipped, the hair should be washed over night in vinegar to loosen eggs, then the eggs wiped off with a towel wet with bichloride.

Room.

Choose with reference to light, air and convenience for nursing.

Bed.

(See Typhoid Fever, Chap. V.)

Care of the body.

- Daily cleansing bath.
- Try to prevent bed-sores by turning patient.
- Rubbing the point of pressure.
- Keeping the parts dry.
- Using rings or cushions.
- For superficial sores.
  - Keep sores scrupulously clean.
  - Use drying powders such as
  - Stearate of zinc,
  - Zinc oxide,
  - Talcum and starch mixtures,
  - Aristol.
- Deep sores.
  - Treat on surgical principles.
  - Use water bed or air bed.
- Mouth and nose.
  - Use mild antiseptics, such as 2 per cent. to 4 per cent. boric acid solution, especially after feeding.
  - When mouth is in bad condition, treat as in typhoid fever. (See Chap. V.)

Bowels.

As in other infectious diseases. (See Typhoid Fever, Chap. V.)

Diet.

Rules for feeding and details for feeding may be borrowed from Typhoid Fever. (See Chap. V.)
Water should be given freely, and, if patient is stuporous, offered every hour.

Symptomatic treatment.

- Fever.
  - Hydrotherapy, baths, slushes, packs and sponges as in typhoid fever. (See Chap. V.)

Open air.

Just as in Pneumonia. (See Chap. IV.)

Circulation.

Just as in Pneumonia. (See Chap. IV.)

Nervous manifestations.

- Headache.
  - Ice-cap or coil.
  - Morphine in intense headache.

Delirium.

- Great watchfulness.
- Ice-bag.
- Bromides gr. xv to gr. xxx (1–2 Gm) in water three or four times a day.
- Morphine gr. 1/12 to gr. 1/4 (0.005–0.015 Gm), hypodermically.

Stupor and coma.

- Cold baths. } (See Pneumonia, Chap. IV.)
- Open air treatment. }

Convalescence.

- Usually rapid.
- Increase diet.
- (See text.)

Steam.

- Medicated steam, using
- Compound tincture of benzoin,
- Oil of pine,
- Oil of eucalyptus,
- ʒi (4 c.c.) in a croup kettle, or pitcher or pail with paper cone to conduct it.

Œdema of the larynx.

- Intubation.
- Tracheotomy.
- Scarification.

Bronchitis,
Pneumonia,
Pleurisy,
Empyema. } As under other circumstances.

Diarrhea.

- Prevention—proper care of bowel from beginning.
- Castor oil in small doses or
- Bismuth.
- (See summary under Bacillary Dysentery, Chap. VII.)

Parotitis.

- Precautions, proper care of the mouth.
- When mild no treatment, or see Parotitis or Mumps (Chap. XV).
- Suppurative—treat on surgical principles.

Disinfection.

- Destruction of body louse.
- See above for treatment of clothes and patient's body.
- Room.
  - Burn sulphur.

CHAPTER XXI

YELLOW FEVER

THIS disease, in the elucidation of whose mysteries American physicians have played the leading rôle, like Malaria, is transmitted by the mosquito; more definitely by the female of Stegomyia calopus. She becomes infected during and only during the first three days of man's illness with yellow fever and herself passes through an incubation period of from ten to twelve days before she can convey the disease to another man. After this she may remain infective for a considerable time; for fifty-seven days in one instance.

Symptoms. The onset is sudden with chilly sensations, rise of temperature, headache and backache. After some irregularities the temperature abates about the third or fourth day at which time conjunctival icterus may be seen. After a brief intermission or remission of the temperature and diminution of evidences of intoxication, a renewed fever and toxemia with deepening jaundice, gastric distress, vomiting, even a bloody black vomit, delirium and coma ensues.

Hemorrhages and kidney incompetency are often accompaniments. The pulse is characteristically slow (Faget's sign).

Isolation. We now know definitely that there are three links in the chain of transmission, any one of which, abolished, will prevent infection: (1) Stegomyia calopus; (2) its access to a yellow fever patient; (3) its access later to a well person.

The prevention of (2), then, by isolation becomes imperative; moreover, during an epidemic all suspects, suffering from what may be deemed early symptoms of the disease, should be isolated until the diagnosis can be determined. White's instructions as given in his article in the *American Journal of Medical Sciences,* March, 1913, are so succinct that I will quote them here.

"In dealing with the houses in which known or suspected cases of yellow fever have been discovered, it was my custom first to see whether the house had been properly screened with eighteen-mesh to the inch wire cloth, and to have screening done promptly, using mosquito netting as a substitute for wire cloth, and having the sick-room itself, as a double precaution, screened from the remainder of the house. The sick-room can be easily screened by tacking two ample widths of the netting to the top and sides of the door, and attaching a wooden rod to the bottom of each width, so that the ends projecting in to the door are higher than those at the side resulting in the rod dropping into place and pulling the folds together immediately behind any one passing through.

"With Guiteras I believe in careful screening and in covering all cracks around the sick-rooms; also in the quietness with which the work is done, to prevent disturbing either patient or mosquito. The sick-room window should be screened from a ladder on the outside of the window. In order to prevent escape or entrance through the chimney a cap should be placed on the top, or failing in this, some loose paper should be burned in the fireplace, with a little petroleum to make a rapid flame, and the front of the fireplace covered with a screen of wire netting.

"After the patient is in condition to be removed to another room or house, three days having elapsed since he became ill, he is removed and every crack pasted over into which an insect may hide, and all drawers opened, so that the fumigant used may reach all places in the room, care being taken that no mosquitoes are shut between the outside screen and the window in closing it. The room and its contents are subjected to either sulphur dioxide or cyanide, burning pyrethrum powder or any other fumigant. The whole house is simultaneously treated in the same fashion if the patient can be removed to another house; otherwise we must treat part at a time with more than usual care."

It is seen, then, that after three or four days the patient is no longer a source of infection, but that he is still to be protected against further infection by infected mosquitoes.

His room should be one to which air has the freest access and these patients do very well under a tent in the open air. The room should be darkened.

The room, of course, is to be screened until such time as the patient may be removed from the room in which he was taken ill; that is, at the end of the first three days of his illness, during which his blood contains the virus.

If his condition warrants, he is then removed, and the room is fumigated to destroy the mosquitoes. Doctor and nurses should protect parts of the body liable to be bitten and more especially toward nightfall.

The choice of the bed and the care of the bed observe the same rules as in other acute infectious fevers. (See Typhoid Fever, Chap. V.)

The certain knowledge of the only mode of conveyance of the disease, i.e., by the mosquito, makes the elaborate use of antiseptics, as, for instance, in typhoid unnecessary.

Rest. There are abundant theoretical reasons and such as appeal to common sense, as set forth in the chapter on Treatment of Acute Infectious Diseases (see Chap. I), that should urge getting a patient to bed on the first suspicion of infection, beside the conviction of those experienced in the treatment of this disease that cases put to bed early are less severe and less likely to be fatal.

Isolation makes rest more easily attained than when friends and visitors have free access to the patients. Bed pans are to be used and in feeding the glass tube or feeding cup.

Diet. Gastric irritation is a characteristic of the disease and makes the matter of feeding a difficult one. All writers advise against administering food during the first period of three or four days, while the gastric disturbance continues or the fever remains up; even in the second period if above 102° F.

After four or five days' abstention from food the weakness of the patient may urge upon us the necessity of affording nourishment in some form and recourse may be had to rectal feeding. In severe cases this is almost impossible and in any case great care must be taken not to aggravate the irritability of the colon and rectum.

Agramonte advises feeding in this manner on alternate days, and suggests as a food formula:

Milk	3 ounces (better peptonized)
Whisky	½ ounce
Normal salt solution	3 ounces

When conditions as above enumerated would seem to permit of it food may be begun with caution by the mouth, commencing with much diluted milk, with barley water, ice-cream or gelatine jellies.

Drinks. It is very desirable to administer fluids, if the stomach will entertain them. Alkaline waters seem the best borne.

Carroll advises Vichy or other mineral water, to which is added sodium bicarbonate grains xxx (2 Gm) to the pint (500 c.c.), while Anderson is enthusiastic over his effervescent mixture of Potassium bicarbonate grains xxx (2 Gm) to a dessert-spoonful of freshly expressed and strained lime juice given effervescing in Vichy every two hours.

Mild lemonade may also be administered.

All food and drinks should be ice-cold.

Bowels. A saline ʒiv–vi (15–24 Gm) of Epsom or Glauber's Salts, best in ʒi (4 Gm) doses at frequent intervals, should be given. This may be preceded by small doses of calomel grains iii to gr. v (0.20–0.35 Gm) or this may be divided. If not effectual a plain enema should follow.

Care of the Body and Mouth. The same rules are to be followed as after any severe acute infection. (See Typhoid Fever, Chap. V.)

Treatment of Symptoms. The onset, as has been stated, is sudden and severe and accompanied by headache and backache, often intense.

Headache. It is altogether better to avoid drugs, since the depressant effects of the coal tars and the other pharmacological actions of the morphine series are undesirable, and to rely upon **cold** applied to the head in the shape of cold compresses or the ice-bag or the cold coil.

Experienced clinicians advocate the application of **heat** to the trunk and extremities at the same time, as a hot pack, a hot mustard foot-bath or heat otherwise applied to the feet (see Pneumonia, Chap. IV), and hot drinks such as lemonade if the stomach will stand it. They believe that not only is the headache bettered, but the nausea relieved and the congestion of the kidneys lessened.

Backache. The hot pack, hot stupes, mustard pastes or plasters and rubbing afford relief.

Gastric Distress. Pain, nausea and vomiting are early manifestations often persistent and later in many instances giving rise to the characteristic and ominous black vomit.

No food should be given while the stomach is so irritable; a **counterirritant,** mustard paste or mustard leaf, may be applied to the epigastrium or the application of the ice-bag to the same site may be tried.

Cracked ice is sometimes efficacious or ice-cold drinks in small quantities frequently, such as the alkalinized Vichy water described above and effervescing drinks, as champagne or ginger-ale in tea- and table-spoonful doses.

If the violent vomiting still persists one must have recourse to **morphine** in doses of grains 1/4 (0.015 Gm) hypodermically.

Black Vomit. Among the measures recommended to relieve the serious condition are the hemostatics, such as adrenalin by mouth for its constricting effect on the small arteries. Tincture of ferric chloride in doses of minims 5 (0.35 c.c.) every two hours for the styptic effect on the bleeding orifices given in lime-juice and glycerin and (Guiteras) calcium chloride for its effect on the coagulation of the blood and spirits of turpentine in doses of minims x (0.65 c.c.).

Fever. The period of fever is short-lived and rarely excessive and demands no measures except those designed for the comfort of the patient, as sponging with luke-warm or cool water.

If the pyrexia, however, attains high figures or for any time persists above 103° F., the sponges should be given with colder water from 70° F., down to 60° F., or 50° F., depending on the reaction, at four hour intervals. Such **cold sponging** should have a favorable effect on the circulation and on other structures burdened by the toxins.

Urine. Great danger attends the not uncommon involvement of the kidneys and the suppression resulting. Examinations of the urine should be made daily and estimates of intake and output of water noted. The capacity of the kidney for secretion of water is more important than the amount of albumin in the urine. Administration of a sufficiency of water is important, but on account of the gastric irritability difficult of accomplishment. For this reason saline rectal injections are of value given in amounts of 10 to 16 ounces at four hour intervals, or the Murphy drip may be tried, but care must be exercised not to aggravate the irritability of the intestine from which hemorrhages are so likely to occur. At the same time hot fomentations should be applied to the lumbar region or the area cupped in an effort to relieve the congestion.

Circulation. The condition of the heart and of the principal vessels should be determined by frequent examinations and blood-pressure readings.

Depression of the circulation should be met in the same way as in other acute infections. (See Treatment of Acute Infectious-Diseases, Chap. I, and Pneumonia, Chap. IV.)

Convalescence. The period depends on the degree of intoxication throughout the illness. In the usual case it is relatively short, so that after the fever has subsided for several days the patient may be allowed to sit up. The patient gets back onto solid food gradually, the condition of the stomach and kidneys affording the criteria for enlarging the diet.

Prophylaxis. Three lines of endeavor to prevent infection are to be pursued.

(1) Destruction of mosquitoes and elimination of their breeding places.

(2) Isolation of the infected individual.

(3) Precautions against bite of stegomyia by non-immunes.

To effect (1), the destruction of the mosquitoes and the elimination of their breeding places, the following measures are undertaken: First, as described under the section on isolation, by carefully screening the room from the first and by removal of the patient after three days of illness with care not to disturb the mosquitoes, followed by fumigation of the tightly sealed room.

White calls the stegomyia calopus a domestic mosquito; that is, that it clings closely to the habitat of man and breeds in water collected in artificial receptacles, cisterns, barrels, tubs, cans, broken crockery, pools, vases, fountains, drains, roof gutters, in fact in any stagnant water commonly to be found about a dwelling.

Of course, all useless litter should be destroyed or disposed of; cisterns, drains, etc., properly screened with wire netting or constantly covered with a film of petroleum, while small fish devour the breeding mosquitoes in fish ponds and fountains. Swamps, ponds or stagnant waters about the locality infected must be drained, filled in or treated with petroleum.

(2) The isolation of the infected individual to prevent his being a source of infection to others through mosquitoes first biting him has been dealt with.

(3) Precautions against bites of stegomyia by non-immunes are

first a knowledge of the habits of stegomyia calopus and second, personal protection.

Carroll says the stegomyia is a twilight mosquito, feeding in early morning and from mid-afternoon until late evening (3 P. M.–10 P. M.), and that in well lighted places between 9 A. M. and 3 P. M. there is little danger to non-immunes even in infected localities.

When in an infected locality non-immunes should take care to protect themselves against the bite of stegomyia and that especially at dusk and after dark by wearing mosquito head-nets, heavy gloves and leggings, choosing for a sleeping room as high a room in the house as possible, being assured on retiring that the room is free from mosquitoes, best by fumigating it, sleeping in a screened room and in a screened bed.

They should not expose themselves to the environment of an infected individual unless duty calls and then should take such precautions as are observed by doctors or nurses in attendance.

SUMMARY

Isolation.

Of both patients and suspects.
(For the technique of isolation see text.)

Doctor and nurse.

Must protect themselves against the bite of mosquitoes and more especially toward nightfall.

Bed.

(See Typhoid Fever, Chap. V.)

Diet.

Gastric irritation makes the problem a special one. (See text.)
Drinks.
- Alkaline waters.
- Vichy or other mineral water with sodium bicarbonate gr. xxx (2 Gm) to the pint (500 c.c.) (Carroll).
- Potassium bicarbonate gr. xxx (2 Gm) in a dessert spoonful (ʒii or 8 c.c.) freshly expressed and strained lime juice given effervescing in Vichy, every two hours (Anderson).
- Mild lemonade.
- All drinks ice-cold.

Bowels.

Epsom, Rochelle or Glauber's salts ʒiv–vi (15–25 Gm), best in doses of ʒi (4 Gm) at frequent intervals.
May precede by calomel gr. iii to gr. v (0.20–0.35 Gm) in one or divided doses.

Care of body and mouth.

(See Typhoid Fever, Chap. V.)

Treatment of symptoms.

- Headache.
  - Cold to head.
  - Ice bag.
- Heat to extremities.
  - Hot pack.
  - Hot mustard foot-bath. (For technique, see Pneumonia, Chap. IV.)
  - Hot drinks; e.g., lemonade.
- Backache.
  - Hot pack.
  - Hot stupes.
  - Mustard paste or plasters.
- Gastric distress.
  - No food by stomach.
  - Mustard paste or plaster to epigastrium.
  - Ice bag to epigastrium.
  - Cracked ice to suck.
  - Ice cold drinks in small quantities.
  - Alkaline Vichy. (See above.)
  - Effervescing drinks.
    - Champagne, Ginger Ale. } In teaspoonful or tablespoonful doses.
    - If vomiting is severe morphine hypodermically gr. 1/4 (0.015 Gm).
- Black vomit.
  - Adrenalin, in doses of m. i to m. xv (0.060–1 c.c.).
  - Tincture of the chloride of iron m. v (0.30 c.c.) in lime juice and glycerin.
  - Calcium chloride (Guiteras) gr. x to gr. xv (0.60–1 Gm).
  - Spirits of turpentine m. x (0.60 c.c.).
- Fever.
  - Needs consideration only when high or very sustained.
  - Cold sponges.
- Kidneys.
  - Congestion.
    - Hot fomentations over lumbar region.
- Circulation.
  - As in other acute infectious diseases.
  - (See summary under Pneumonia, Chap. IV.)

Convalescence.

- Usually short.
- Up after temperature is normal a few days.
- Increase diet as condition of stomach and kidneys warrant.

Prophylaxis.

1. Destruction of mosquitoes.
   (See Malaria, Chap. VI.)
2. Isolation of the infected individual.
   (See text under isolation.)

3. Protection of non-immunes against bite of stegomyia.
    - Noting the feeding time, in morning until about 9 o'clock, and evening after 3 o'clock.
    - Wear mosquito head nets, heavy gloves and leggings.
    - Choose as sleeping room one high up.
    - Sleep in screened room and screened bed.
    - It is well to fumigate the room before retiring.

Avoid exposure to environment of infected individuals.

CHAPTER XXII

PLAGUE

PLAGUE is a disease due to an infection by the Bacillus pestis bubonica isolated by Kitasato in 1894. This organism affects peculiarly the lymphatic glands, the swelling of which gives the characteristic appearance to the infected and the designation "bubonic plague."

The especial **carriers** of the organisms are rats and the fleas infesting them afford the communication between the rat and man.

Rats, however, are not the only carriers, and conveyance may be made through other insects than fleas, and through the patient by pus, vomitus, sputum, sweat and urine.

While the bubonic form of the plague is the common one, the predominance of other clinical symptoms may warrant other designations, as when the lungs or intestine are the organs especially affected; hence, Pneumonic or Intestinal Plague; or, when the toxæmia dominates the picture and is termed Septicemic or Fulminating Plague or the opposite obtains and the toxæmia and local manifestations are slight, Pestis minor or Abortive or Ambulatory Plague.

So rapid and wide-spread is the plague, so frightful its consequences that the consideration of the community overshadows that of the individual and renders the chapter on prophylaxis by far the most important in the story of Plague. This will be considered presently.

Therapy. An article of this kind can deal only with the general principles applicable to the individual. A stricken community demands the accumulated fruits of experience in precautions, details and technique that can only be afforded by more exhaustive treatises or infinitely better yet by the presence and control of men of actual experience in plague epidemics.

Isolation. The knowledge that each individual is a center of infection, through his secretions, makes his isolation imperative and that this infection may be conveyed by insects, such as flies, ants and so on contaminated by these secretions or through the bites of infected insects, as the flea demands screening against all insects.

Room. The room should be well aired and accessible to sunlight, as darkness and dampness favors the persistency of the organism; an ideal is a temporary shack or shelter rather than in an old and rat-infested house.

The bed should be of the hospital type; of iron, hence, readily kept clean. The room should be stripped of everything except the absolutely necessary.

Physician and nurse should wear gowns, caps and especially rubber gloves and in pneumonic cases protect the face with gauze masks such as are used by surgeons, which may be kept moist with some antiseptic solution, and glasses to protect against infection coughed into their faces. Doctors and nurses should take advantage of such protection as vaccine by Haffkine's or Shiga's method will afford.

Sputa should be received on gauze or rags and these should be burned. Vomitus, feces and urine should be disinfected and clothes, bed linen, utensils and instruments sterilized as in Typhoid Fever. (See Typhoid Fever, Chap. V.)

Cleansing baths, the care of mouth, nose, eyes, skin and genitals all demand the same consideration as in Typhoid Fever. (See Chap. V.)

Diet. Without forcing the food against the patient's distaste, an effort should be made to approximate food needs, however remotely. Milk and milk preparations, cereals, broths thickened with cereals or farinaceous foods, moistened bread or toast, eggs, may all be used. Water should be given abundantly.

Bowels. An initial cathartic with divided doses of calomel, gr. 1/4 (0.015 Gm) every quarter hour for six or eight doses, followed in two hours by salts, Rochelle, Epsom, or Glauber's ℥ss–℥i (15–30 Gm) may be given. Later at two day intervals milder salines or enemata may be used.

Bladder. It must not be forgotten that in the very ill urine may be retained and if lesser measures of heat or cold over the hypogastrium fail, catheterization, with all precautions, must be undertaken.

Fever. The temperature is rarely high enough to demand especial consideration. It lasts, as a rule, from a week to ten days and is very irregular. Sometimes, however, the fever lasts for several weeks and then the increased caloric needs and protein destruction, effects of the toxæmia, demand particular consideration of the dietary.

Rarely excessive fever requires antipyretic treatment which is best afforded by cold water in the shape of sponges and packs or if the buboes are not discharging or too painful as tubs. Antipyretic drugs are depressing to the circulation and should not be used.

Circulation. Good nursing, fresh air, food and cool or cold sponging are the best guarantees of a good circulation.

If drugs are to be used the indications are the same as in the other acute infections. (See Pneumonia, Chap. IV.)

Nervous Symptoms. Headache—is best controlled by the icebag applied to the head.

Delirium may demand restraint.

Sleeplessness is to be met by the milder hypnotics or morphine may be needed to control these symptoms.

Buboes. As the swelling increases rapidly the pain may be very great. Perhaps the best means to relieve this is the application of the ice-bag. At times the pain may be so severe as to demand morphine. Hot fomentations are also used to hasten suppuration.

When fluctuation occurs incision is indicated and the wound treated on surgical principles.

Diarrhea. When this occurs the best drug to use is bismuth. Some writers consider opium contraindicated, as defeating the effort at elimination of toxins.

SPECIFIC TREATMENT

Serum. An anti-plague serum comparable to antidiphtheria serum has never been elaborated, but, especially, the Yersin-Roux has been tried with results that have elicited different interpretations.

I quote from Wherry's article in Forchheimer's *Therapeusis of Internal Disease.*

"The discussion concerning the value of the Yersin-Roux anti-plague serum has apparently been satisfactorily disposed of by Chosky. His series includes 1,081 cases treated in India during 1905–1907. In this series only every alternate case was treated with the serum, the others acting as controls. Very mild cases and severely septicemic and moribund cases were excluded.

"The general mortality was reduced to 49.6 per cent. In cases treated during the first day of the disease the mortality was 30 per cent.; this increased to 52 per cent., among those treated on the second day, and to over 60 per cent., among those treated on the third day."

Of course the value of such statistics increases with their number.

As the general mortality of the Plague in India at this time was 89.9 per cent., the reduction under the serum treatment was remarkable; but in addition the disease was shortened, and the complications lessened.

Early administration is all important and a sufficiency of serum 100–200–400 c.c. should be given and early repeated, in six and eight hours and again at week intervals as the condition of the patient seems to demand.

Intravenous administration is always to be preferred, but intramuscular and subcutaneous are often combined with it.

The best serum at present seems to be the so-called Yersin serum, obtained by inoculating horses with dead organisms, and later with increasing quantities of living virulent organisms.

Sequelæ. Aside from the rarer sequelæ prolonged suppuration of buboes and cardiac weakness in convalescence are matters of moment.

Convalescence. Fresh food and fresh air and prolonged rest with watchfulness over the state of the circulation are the essential measures.

Disinfection. This should be thorough and effective and much the same measures should be pursued as in Scarlet Fever. (See Scarlet Fever, Chap. IX.)

Prophylaxis. Since the Indian Commission has so clearly demonstrated the rôle of the rat and his fleas and with our knowledge of the contagiousness of the secretions of infected men, prophylactic measures can be directed with definite ends in view.

It must not be forgotten, however, that while rats are the usual carriers, other animals may harbor and convey the infection and that in our own country the California ground squirrel especially plays this rôle.

Jackson, in Hare's *Modern Treatment,* sums up protective measures for the community in this way:

"(1) Active warfare against rats and other plague affected rodents, and their fleas;

(2) quarantine applied to persons, goods and animals;

(3) disinfection of cargoes shipped from infected ports;

(4) isolation of the sick and proper disposal of the dead;

(5) international notification between governments of the occurrence of plague within their respective territories;

(6) lastly, but perhaps first in importance, the early recognition of the presence of the plague and rapid diagnosis in individual cases, both dependent upon laboratory workers."

Warfare against the rat entails the building of rat-proof structures in ports; the prevention of ingress and egress of rats when ships are in port, by protection of hawsers and raising of planks at nightfall; the proper disposal of garbage on which they feed. In some communities cats have been employed for the purpose, though not entirely a safe procedure; as cats have been shown to develop a chronic form; stopping up of their holes and the use of poisons and traps. Prophylactic measures may be applied to the individual as well.

Perhaps the most efficacious of these methods is the use of Haffkine's prophylactic inoculation.

It consists of a broth-culture of bacillus pestis killed by heating and preserved in 0.5 per cent. carbolic acid and injected subcutaneously in specified amounts.

That it has protective power, that it has modified both the incidence and mortality of statistics seem now to have been proved beyond a doubt; but the protection is not absolute even though immunity seems to be marked in the second year and remains in a slight measure in some cases for five years.

A modification of this method has been devised by Shiga that has the advantage of quicker preparation.

If given within a few hours after first appearance of symptoms it seems to have some curative value.

SUMMARY

Isolation.

Room.

Well aired and light and screened from flying insects.

Bed.

Hospital type preferred.
(For technique of bed-making see Typhoid Fever, Chap. V.)

Physicians and nurses.

Wear gowns and gloves and in pneumonic cases wear gauze masks to protect face against the patient's cough.
Prophylactic vaccination is a wise precaution.

Care of patient.

Care of body and mouth, nose, eyes and genitals as in any acute infectious disease. (See Typhoid Fever, Chap. V.)
Sputa should be received on gauze or rags and burned.
Vomitus, feces, urine disinfected and clothes, bed-linen, utensils, and instruments sterilized as in Typhoid Fever. (See Chap. V.)

Diet.

Do not force, but keep in mind food requirements. (See Chap. II.)
  Milk, milk preparations, cereals, broths thickened with cereals, or farinaceous foods, moistened bread and toast, eggs.
Water should be given freely.

Bowels.

Initial cathartic.
  Calomel in divided doses, gr. 1/4 (0.015 Gm) every quarter hour for six or eight doses, followed in two hours by
Epsom salts, Rochelle salts or Glauber's salts ℥ss to ℥i (15–30 Gm) in three quarters glass of water.
  Later.
    Milder salines, Hunyadi, Citrate of magnesia,
    Milk of magnesia or enemata every day.

Retention of urine.

Apply heat (hot stupes) or cold to epigastrium. If these fail catheterize.

Fever.

Cold sponges.
Cold packs.
Cold tubs.

Circulation.

(See Pneumonia, Chap. IV.)

Nervous symptoms.

- Headache.
  - Ice bag or coil.
- Delirium.
  - Restraint.
  - Bromides gr. xxx (2 Gm) one to three times a day.
  - Morphine hypodermically gr. 1/8–1/4 (0.008–0.015 Gm).
  - Hyoscine hydrobromate gr. 1/150 (0.0004 Gm).
- Sleeplessness.
  - Bromides gr. xxx (2 Gm) in water.
  - Trional gr. xv (1 Gm) in a little hot water or whiskey or as powder.
  - Chloralamid gr. xxx (2 Gm) in cold water or whiskey or powder.
  - Morphine gr. 1/8–gr. 1/4 (0.008–0.015 Gm).

Buboes.

- Ice bag.
- Morphine for pain gr. 1/8–gr. 1/4 (0.008–0.015 Gm).
- Hot fomentations to hasten suppuration.
- Incise when fluctuation is detected.
- Treat on surgical principles.

Diarrhea.

- Bismuth subnitrate gr. xxx (2 Gm) every two hours.
- Specific treatment.
  - (See text.)

Convalescence.

- Fresh food.
- Fresh air.
- Prompt rest.

Disinfection.

(See Scarlet Fever, Chap. IX.)

Prophylaxis.

CHAPTER XXIII

DENGUE

Dengue, essentially a tropical disease, is confined in the United States to the Southern tier of States. Although epidemics have been reported as far north as Philadelphia.

It is characterized by a suddenness of onset, and a rise of temperature with severe headache and pains all over the body that closely simulate Influenza. These manifestations of intoxication last two to five days and are followed by a remission or intermission of symptoms of twelve hours to three days, only to be in turn followed by a second febrile period of twenty-four to thirty-six hours. An erythema may accompany the first period, but the characteristic rash occurs with the second access of fever involving hands first, spreading to arms and later involving lower extremities and trunk.

Profound depression of spirits accompanies the attack and the convalescence is slow. The mortality is, however, very low.

This disease, like Malaria and Yellow Fever, is in all probability transmitted by a mosquito (Culex fatigans) as suggested by Graham of Beirut, though as yet not definitely proved.

Ashburn and Craig, by transmitting the disease through the filtered blood of an infected person, have made it more than probable that the infecting agent belongs to the group of ultramicroscopic organisms.

Therapy. The room chosen for the patient should be as cool and airy as possible or better yet a shaded portico. This should be screened against mosquitoes, not merely as a protection to the patient, but as a protection to others against the patient.

The bed should be selected with a view to comfort as the bodily pains are so great as to make any position one of discomfort. (See Rheumatic Fever, Chap. III.)

Diet. No effort should be made to force food during the period of anorexia, but after this has passed milk and milk preparations, cereals, bread-stuffs and eggs, cereal broths or mutton and chicken broths thickened with rice, sago or barley may be given as freely as the patient will accept of them, while during the long and tedious convalescence a greater variety of foods temptingly prepared and with a consideration to the patient's caloric needs (see Chap. II) should be offered.

Water should be given freely throughout the febrile periods or fruit juices such as lemonade or orangeade or juice of grape fruit.

Bowels. At the beginning of the disease the bowels should be freely moved by small doses of calomel and salts, e.g., calomel gr. ¼ (0.015 Gm) every quarter hour for six to eight doses, followed by ℥ss (15 Gm) of Epsom or Rochelle salts, and every second day a mild saline such as a Seidlitz powder or Liquor magnesii citratis ℥viii–xii (240–360 c.c.) or Hunyadi water may be administered.

There should be no purging as the condition does not demand it and the patient's pains and discomforts are greatly aggravated thereby.

Pains. The milder anodynes such as salicylates in gr. x (0.65 Gm) doses every two hours or phenacetin gr. iii to v (0.20–0.30 Gm) at like intervals should be tried first, but the pains are commonly too severe to yield to such measures and one should have recourse to codeine sulphate or phosphate gr. ⅛ to gr. ¼ (0.008–0.015 Gm) every two hours.

At times, however, the headache and pain is so acute that one must use morphine. It is always well to administer this drug hypodermically rather than by mouth and in the smallest doses that will effect the desired results, e.g., a beginning dose of gr. 1/12 (0.005 Gm).

Local Treatment of Pains. An ice-bag to the head may mitigate the severity of the headache while hot cloths, stupes or poultices may give relief to aching back and joints.

Fever. No effort is to be made to combat the fever as such, as hyperpyrexia is very rare, but measures to assuage the discomforts incident upon the temperature are legitimate, such as cool sponges, cooling drinks, ice-bag to head.

Tub baths add too much to the patient's pains in the handling to warrant the procedure unless hyperpyrexia should obtain.

Circulation. The pulse is characteristically slow about the third day, but the circulation is rarely threatened. Should one be dealing with a poor circulation as the result of an antecedent condition, the toxæmia, or both, the indications are the same as in a case of Pneumonia. (See Pneumonia, Chap. IV.)

Nervous Symptoms. To a patient suffering from Dengue nothing is more gratifying than to be let alone. Quiet and good nursing and the exclusion of visitors are of first importance to him.

Insomnia may be overcome by excluding causes of nervous irritation, by the artifices of efficient nursing and lastly by drugs, e.g., trional gr. x (0.65 Gm) in the early evening and a repetition of the dose two hours later if needed or chloralamid gr. xxx (2 Gm) at the same intervals.

If pain is the cause of the insomnia codeine gr. ¼ (0.015 Gm) to gr. ss (0.030 Gm), may be used to assist the operation of the hypnotics, but in cases of severe pain only morphine, as already specified, will be of use. With this the other hypnotics are unnecessary.

Complications. Occasionally hemorrhages may occur from nose, stomach, intestine or uterus. Milder hemorrhages need no consideration, but if abundant or in weakly patients, the same measures are to be pursued as in hemorrhages from other causes. (See Typhoid Fever, Chap. V.)

Convalescence. It is curiously protracted for an infection so little fatal and is to be hastened by a sufficiency of food, fresh air, quiet and milder tonics such as nux vomica and iron.

Prophylaxis. Accepting the theory that the mosquito is the transmitting agent of the disease efforts should be made to rid the community of the pests by draining swamps, obliterating or treating with oil all stagnant water, ponds, pools, cisterns, and removal of smaller containers, such as buckets, cans, etc., together with screening of dwellings and protection of the exposed parts of the body at night-fall. Especially, as has been said, the infected patient should be screened.

Diagnosis. Features of diagnostic significance are the two febrile periods separated by the remission, the severity of the pains, the slow pulse, the rash of the second period, the low white cell and polymorphonuclear count (e.g., 3,200 whites and 51 per cent. polymorphonuclears) and the protracted convalescence.

SUMMARY

Room.

Cool and well ventilated.
Shaded and screened porch or veranda desirable.

Bed.

Preferably of hospital type, with woven wire springs, firm mattress and smoothly laid sheets.

Diet.

Do not force during period of anorexia.
Milk, milk preparations, cereal broths, mutton or chicken broth thickened with rice, barley or other cereal or farinaceous flour.

Water.

Give freely.
Lemonade, orangeade and other diluted fruit juices. May add sugar to increase food value.

Bowels.

Calomel and salts or salts alone.
Calomel gr. ¼ (0.015 Gm) every quarter hour for six to eight doses.
Epsom salts ℥ss (15 Gm).
Rochelle salts ℥ss–i (15–30 Gm).
Seidlitz powder.
Liquor magnesii citratis ℥viii to xii (240–360 Gm).
Hunyadi water.

Treatment of symptoms.

- Pain.
  - Local.
    - Hot fomentations. (See Pneumonia, Chap. IV.)
    - Poultice. (See Pneumonia, Chap. IV.)
    - Salicylates (of Sodium or Aspirin) gr. x (0.60 Gm) every two hours.
    - Phenacetin (acetphenetidin) gr. iii to gr. v (0.20–0.30 Gm) every two hours.
    - Codeine sulphate or phosphate gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$ (0.008–0.015 Gm) every two hours.
    - Morphine hypodermically gr. $\frac{1}{12}$ to gr. $\frac{1}{8}$ (0.005–0.008 Gm).

Fever.

- Cool sponges.
- Cool drinks.
- Ice-bag to head.

Circulation.

- Rarely threatened.
- If stimulation is indicated, see Pneumonia, Chap. IV.

Nervous symptoms.

- Marked irritability allayed by quiet and good nursing.

Insomnia.

Trional gr. x (0.60 Gm). Chloralamid gr. xx (1.30 Gm).	May repeat in two hours.
Codeine gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$ (0.008–0.015 Gm). Morphine gr. $\frac{1}{12}$ to gr. $\frac{1}{8}$ (0.005–0.008 Gm).	If due to pain.

Complications.

- Hemorrhages. (See text.)
- If severe same as Typhoid Fever, Chap. V.

Convalescence.

- Protracted.
  - Increase food intake.
  - Fresh air.
  - Strychnine gr. $\frac{1}{60}$ to gr. $\frac{1}{20}$ (0.001–0.003 Gm) or
  - Tr. nucis vomicæ m. x to m. xv (0.60–1 c.c.) three times a day.
  - Iron as carbonate gr. v (0.30 Gm) three times a day.

Prophylaxis.

- War on the mosquito.
- (See Malaria, Chap. VI.)

CHAPTER XXIV

ASIATIC CHOLERA

Asiatic Cholera is due to a definite organism, the so-called "comma bacillus" discovered by Koch in 1883 or more technically, the vibrio choleræ asiaticæ.

It is conveyed by the dejecta of the infected directly or through the medium of water and always gains entrance through the mouth.

Its toxin and endotoxin acts specifically on the endothelium of the intestinal canal to induce those alterations in function that constitute the symptoms of the disease, namely excessive diarrhea with collapse.

The mortality is high, approximately 50 per cent. and is especially fatal to the two extremes of life.

Isolation. During a cholera epidemic the slightest diarrhea should be looked upon as suspicious and the patient should be put to bed and everything be done to conserve his strength for the coming struggle.

The problem of protection against infection is a simple one, for we know the source of the infection through the feces, its mode of conveyance through hands, articles, insects, food and drink contaminated by the dejecta and the portal of entry through the mouth.

Isolation prevents the ignorant and careless coming into contact with the patient from becoming infected and spreading the disease and prevents added infection to the patient.

Doctor and nurse by an appreciation of the facts just stated should, by use of gowns and gloves, careful cleansing of hands, sterilizations of contaminated objects, and destruction by fire and strong antiseptics of excreta, protect themselves and those with whom they may come in contact.

Room. During an epidemic, of course, the vast majority of patients must be treated in hospitals, camps, etc., but for the favored few, who may be treated under more fortuitous environments, a room, as cool and as well ventilated as possible should be chosen and this stripped of all furnishings and hangings. In fact the source and mode of conveyance of this disease is so like typhoid fever that the details of room, bed, sterilization of articles used, and care of the body are identical problems. (See Typhoid Fever, Chap. V.)

Diet. At first it is well to eliminate all food-stuffs, except barley-water, which is best given hot. Later other farinaceous gruels, such as arrowroot water, rice water, whey, and then cautiously animal broths thickened with farinaceous foods, and then milk.

These are dietetic measures similar to those we use in the gastroenteritis of infancy.

Water is given abundantly in small quantities freely and not too cold.

Early Treatment. The sooner the patient is put to bed after the looseness of the bowels appears the better. He should be covered warmly, given hot drinks, hot weak tea or lemonade and hot stupes or poultices should be applied to the abdomen.

At this early stage opium may be given, but later in the disease it is a dangerous drug. One may give m. xx (1.30 c.c.) of the tincture or ℥ss–℥i (15–30 c.c.) of paregoric or in smaller and frequent doses, as m. ii (0.15 c.c.) of the tincture or gr. ⅕ (0.012 Gm) of Dover's powders or ʒi (4 c.c.) of paregoric every hour.

Cathartics. Rogers, whose masterly article in Hare's *Modern Treatment,* should be read with attention by all who deal with this disease, decries the use of cathartics in cholera at any stage.

Stage of Collapse. Rogers' treatment while not specific, is deduced so logically from what we know of physiological requirements, that I shall summarize it for the purposes of this article with a frank confession of the shortcomings of such a summary.

Rogers recognizing the obvious fact that the loss of fluids from the tissues constitutes the danger of the disease and that its replacement is the procedure that the logic of the situation demands, finds his success in the appreciation of the significance of certain minor details.

He recognized that not only is there a loss of fluid by the tissues, but also a marked loss of salts, both of which should be replaced, and argued that if salts were introduced in hypertonic solution osmotic currents could be determined toward the blood from the bowel instead of away from it as induced by the toxic agents.

The condition of the blood he estimated by determining its specific gravity. This he does by blowing a drop of blood into mixtures of glycerin and water of known specific gravities from 1,040–1,076 corresponding to the normal specific gravity of the blood and noticing whether it sank, rose or remained for a time suspended.

The state of the circulation is gauged by the sphygmomanometer.

If the pressure is 70 mm. or over, saline may be absorbed from the bowel and unless indications are urgent treatment may be begun in this manner.

He uses a solution of NaCl gr. 90 to one pint (6 Gm to 500 c.c.) at blood heat ½ to 1 pint (250–500 c.c.) introduced very slowly two hours or by the Murphy drip method.

This is kept up until the kidneys act freely.

If, however, the blood pressure is below 70 mm. Hg., or the patient has severe cramps, is restless or cyanotic a saline should be given intravenously as the subcutaneous method is often ineffectual due to failure of absorption.

The efficacy of this method Rogers attributes largely to the concentration of the solution. The formula he advises is as follows:

Sodium chloride	120 grains.	(8 Gm)
Calcium chloride	4 grains.	(0.250 Gm)
Potassium chloride	6 grains.	(0.370 Gm)

To each pint of water (500 c.c.).

This is injected at body temperature.

Three to four pints are usually injected, aiming to bring the blood pressure up to 110 mm. Hg. The injection is carried on at the rate of about 1 pint in five minutes.

Indications for interruptions of the injection or lessening the rate of inflow are headache, dyspnœa or sense of oppression in chest.

Rogers' second point of attack is on the toxins of this disease before absorption.

For this purpose he advocates highly the use of calcium or potassium permanganate, preferably calcium as an oxidizing agent.

He gives it in the drinking water, 4 or more grains to the pint (0.25 Gm to 100 c.c.) (much more than 4 is not readily swallowed) in such quantities as the patient can be made to drink, or in gr. ii (0.125 Gm) pills coated with salol or keratin every quarter hour for four doses, then every half hour until gr. xx are taken, in four hours, then omit four hours (or take gr. v (0.30 Gm) bismuth salicylate every hour for these four hours), then one pill every half hour for four hours, then stop four hours and so on over again until stools change color and become less (usually in twenty-four hours).

At the beginning of the second day 16 grains more are administered.

Vomiting. As lesser measures one may try cracked ice or a mustard paste to the epigastrium or subcarbonate of bismuth in gr. xv (1 Gm) doses or if the vomiting is very severe lavage may be tried. In the early stages a hypodermic of morphine gr. ¼ (0.015 Gm) is warrantable and perhaps more likely to be efficacious than any other measure, but during the stage of collapse Rogers maintains its use constitutes a real danger.

During collapse warmth to the surface of the body is indicated by the applications of hot blankets and hot water bottles. Hot drinks are also given, friction to the skin and extremities and stimulants administered (see below). Heat, however, should not be applied during intravenous injection as the febrile reaction accompanying it may pass over into hyperpyrexia.

Stage of Reaction. With a cessation of vomiting, a diminution in the stools, improvement in their consistency and color (bile retained), a slowing of the pulse, and warming of the body surface, the stage of reaction sets in and brings hope with it and yet this period is fraught with no inconsiderable dangers that has warned the physician to abate no jot or tittle in his vigilance.

The possibilities for disaster in this stage rest in hyperpyrexia, suppression of urine and uræmia.

Hyperpyrexia. Large bodies of statistics attribute 10 per cent. of deaths to hyperpyrexia. Rogers believes it due not so much to pyrexia as the rapid absorption of toxins from the gut as the circulation picks up under the febrile reaction.

He believes his permanganate treatment has lessened the mortality from this cause. He also warns against the use of heat applied to surface of the body during saline infusion.

Anuria is to be met by the supply of fluid to the tissues by frequent administrations by mouth and rectum and if specific gravity of blood is not too low (Rogers) by vein as saline solutions.

The kidneys may be cupped, cardiac stimulants such as strophanthin gr. 1/120–gr. 1/60 (0.0005–0.001 Gm) or rapid vaso-motor stimulants such as adrenalin m. x–xv (0.60–1 c.c.) into muscle or m. ii–v (0.125–0.30 c.c.) into vein to be used.

Specific Treatment. Serum has been used but unfortunately as yet with little result. Prophylactic inoculations of the cholera vibrio by Haffkine have been adopted. Such treatment after evidences of infection occur is of no value and there are theoretical reasons for the belief that it is then distinctly harmful.

Stimulants. A sufficiency of water in the circulation is the best stimulant and that the intravenous injection seeks to assure. However, if this fails, we must use whatever other means we have at hand that gives us any promise of assistance and look for such among the drugs.

Probably no drug is comparable to **digitalis** for sustained effect upon the circulation and should be administered in doses of m. xx (1.30 c.c.) of the tincture every six hours. It requires some thirty-six hours or more, however, for it to exert its effect and it seems to me that for more immediate effect strophanthin in doses of mg. ½–1 (gr. 1/120–1/60) intravenously would be indicated here as in other acute infections accompanied by circulatory failure.

For vaso-motor stimulants one may have recourse to camphor gr. v (0.30 Gm) in oil or caffeine sodium salicylate or caffeine sodium benzoate gr. v (0.30 Gm) in watery solution every four hours or alternate at two hour intervals or strychnine sulphate gr. 1/40 (0.0015 Gm) every three to four hours.

All should be given deep into a muscle or if collapse is severe into a vein.

Prophylaxis. Wherry has divided this subject into

(1) Communal and (2) Individual Prophylaxis.

Communal Prophylaxis. This means proper quarantine, sanitary supervision and control of water and food supply, bacterial examination of the excreta of all suspects, which includes all persons coming from foci of infection, many of whom may be true carriers, themselves free from any symptoms of the disease.

Isolation of Suspects. This should entail a detention of at least five days.

Individual Prophylaxis. This entails the realization that the infection enters by the mouth; that it comes by way of drinking water; hence, all water should be boiled; that it comes by way of food; hence, only recently cooked foods, carefully protected from flies, and no raw foods should be eaten; that it comes from fingers or utensils soiled by excreta; hence, careful sterilization of utensils, protection of hands by gloves, when in contact with patients, and by cleansing in sterile water and antiseptic solutions; that it comes from flies or other insects bearing excreta on their legs to food and drink; hence, screening of patient and of food; that anything which reduces the resistance of the epithelial lining of the intestine enhances the likelihood of an attack; hence, especial attention should be given to diet during a cholera epidemic. This means eating in moderation, avoidances of all questionable messes and highly seasoned and garnished dishes; raw fruits and vegetables, large quantities of very cold water and alcoholic excesses.

Vaccines have been used as a prophylactic measure with some degree of success.

Complications. These are numerous but Pneumonia, prolonged dysentery, profound weakness determining a long convalescence are the most common.

Convalescence is to be met by a careful return to a sufficient diet, good air and rest.

I cannot do better than quote bodily the summary of treatment from Rogers to whose excellent article I owe so much.

Summary. "In the first place, the blood-pressure and specific gravity of the blood should be estimated and the axillary and rectal temperature taken. If the blood-pressure is 70 millimeters of Hg. or over, the patient quiet, and the general condition good, rectal saline injections may be tried, a careful watch being kept on the pulse, so that any further fall may at once be detected and more active measures adopted. If the specific gravity is very high, such as 1,070, transfusion should not be delayed. If the blood-pressure on admission or later falls below 70, and especially if the patient is restless, cyanosed, and suffering from severe cramps, no time should be lost in giving an intravenous injection, the hypertonic Ringer solution being used. Sufficient should be injected to obtain not only a fair, but a strong, full pressure-pulse, so as to at once restore the urinary secretion. Four pints are commonly necessary in a severe case in an adult male, and proportionately less in women and children. It should be given at body heat unless the rectal temperature is below 90° F., when the temperature of the solution should be a few degrees higher until the surface temperature is restored. A careful watch should be kept on the temperature reaction which always follows intravenous salines, and the necessary measures taken to prevent an excessive rise occurring.

"In the acute stage nothing should be given by the mouth except the permanganate, drinks and pills, and some antiseptic, such as bismuth salicylate. If the acute stage is prolonged, barley-water may also be necessary. If the collapse recurs, the hypertonic injection must be repeated, being given at a slower rate if the specific gravity of the blood is not much raised, and at a subnormal temperature if there is fever present.

"If a second hypertonic injection is required, the prognosis becomes much graver, although a majority of even such cases may be saved.

"Once the stage of copious evacuations and collapse is past, the all-important indication is to dilute the blood to at least the normal point, and to raise the blood-pressure high enough to restore the secretory activity of the kidneys, and so insure the excretion of the toxins and the prevention of the uræmic complications. If the specific gravity of the blood remains above normal, and is not rapidly reduced by continuing the salines by the bowel and the water by the mouth, a further smaller subcutaneous or slow intravenous injection of normal saline solution is indicated. In addition, cardiac tonics and vaso-constricting drugs are of great service.

"Great caution is necessary in adding to the diet during early convalescence, animal albumins being especially liable to induce a relapse, while starvation for two or three days is less injurious in otherwise healthy subjects whose age is not at either extreme of the scale." (Hare's *Modern Treatment.*)

SUMMARY

Isolation.

Of all real cases and all suspects (those who during an epidemic have diarrhea).
Destruction of all dejecta and sterilization of objects coming in contact with the patient or his excretions.
(For details see Typhoid Fever, Chap. V.)

Doctor and nurse.

Should use gowns and gloves in performance of duties about patient.
Cleanse hands with soap and water, and follow with alcohol or 1 to 1,000 bichloride, even if gloves were worn.

Room.

Chosen with reference to ventilation.
Stripped of all hangings and ornaments.

Take especial care to keep flies from the room and dejecta.
For details of care of room, care of the bed, and sterilization of objects, see Typhoid Fever, Chap. V.

Diet.

At first only barley-water, best given hot.
Little later other farinaceous gruels.
Arrowroot water.
Rice water.
Animal broths thickened with farinaceous foods (cautiously).
Whey, then
Milk.
Water freely in small quantities frequently, not too cold.

Rest.

Put to bed at earliest sign of diarrhea.
Give hot drinks, weak tea or lemonade.
Cover warmly.
Hot stupes or poultices to abdomen.
(For technique of stupes, see Chap. V.)
(For technique of poultices, see Chap. IV.)

Opium.

May be given early, not late.
Tr. opii m. xx (1.30 c.c.).
Paregoric ʒss to i (15–30 c.c.).
May divide above doses and give at short intervals
Dover's powder gr. ⅕ (0.010 Gm) every hour.

Cathartics.

Should not be used at all.
Roger's treatment of hypertonic salt solutions and potassium permanganate. (See text.)

Vomiting.

Cracked ice to suck.
Mustard paste to epigastrium. (For technique, see index.)
Bismuth subnitrate in doses of gr. xv (1 Gm).
If severe, lavage.
Morphine gr. ¼ (0.015 Gm).

Collapse.

Warmth to body.
Blankets.
Hot water bottles.
Friction to the extremities.
Stimulants, see below.
Conditions arising during the
  Stage of reaction.
  Hyperpyrexia.
    Cold sponges.

Anuria.

Fluid to tissues. (See Rogers' treatment, text.)
Cup kidneys. (For technique of cupping see index.)
Cardiac and vaso-motor stimulants, see below.
Specific treatment.
  (See text.)
Stimulants.
  Sufficiency of fluids to the tissues.
  Digitalis, m. xx (1.30 Gm) every six hours.
  Strophanthin in urgent cases gr. 1/120 to gr. 1/60 (0.0005–0.001 Gm) to initiate the digitalis.
  Camphor gr. v (0.30 Gm) in oil 5 per cent. or
  Caffeine sodium benzoate gr. v (0.30 Gm) either every four hours or alternate one with the other every two hours, or
  Strychnine sulphate gr. 1/40 (0.0015 Gm); all given into muscle or vein.
  For immediate effect
    Adrenalin m. xv (1 c.c.) into muscle or m. iii (0.20 c.c.) into vein.

Prophylaxis.

1. Communal.
    Quarantine.
    Supervision and control of water and food supply.
    Bacterial examination of excreta of all suspects.
    Isolation of suspects for five days.
2. Individual.
    Boil water.
    Don't drink large amounts of cold water. Avoid alcohol.
    Eat no raw foods.
    Eat only recently cooked foods.
    Protect food from flies.
    Eat in moderation.
    Sterilization of utensils.
    Protection of hands with gloves when in contact with patients.

Convalescence.

Careful return to sufficient diet.
Fresh air.

CHAPTER XXV

MALTA FEVER

MALTA FEVER in the great ocean of diseases, has like its habitat Malta seemed until recently, an island and a small island at that, of interest only to the physician practicing there or treating the English soldier invalided home, but an article by Ferenbaugh in August, 1911, suddenly made us aware that we harbored the disease in this country in the great State of Texas.

This disease, which affected so widely the British troops stationed in Malta, Gibraltar and a few other Mediterranean localities was found by Bruce in 1887 to be due to a definite organism, the micrococcus melitensis. The mode of its distribution was elucidated by the Mediterranean Fever Commission in their work of 1905–7. They showed that it came largely through the use of the milk of goats so plentiful in the island; that 50 per cent. of the goats were infected, acting as carriers, and that 10 per cent. of them secreted the bacilli in their milk.

In Edwards County, Texas, and in adjacent territory an unclassified slow fever had been recognized under various local designations and had even been associated with the goat and by some called "goat fever." The investigators mentioned found all their cases to be in the goat raising country, among those drinking uncooked goats' milk or handling goats (for the Mediterranean Fever Commission found these animals excreted the micrococci in their urine and feces as well as in their milk), and though the organisms were not found in the milk of the Texas goat, 34 per cent. gave a positive reaction to the agglutination test.

The complement fixation test has since been used in the investigation with positive results.

Gentry and Ferenbaugh give the warning that some of the so-called typhoid fever cases in these sections might prove to be Malta Fever.

The incubation period seems to be about two weeks.

The disease is characterized by the peculiar course of the fever, the curve of which, rising and falling like the waves of the sea, have given it the name of undulating fever.

It is very drawn out, often lasting months (averages give 90–120 days—some last a year or more) and is rife with discomforts, such as headache, backache, neuralgic pains, swollen painful joints, perspiration, gastric disturbance, and not uncommonly an orchitis.

Relapses are the rule and are repeated.

Treatment. Here, as in most diseases, our best treatment lies in husbanding the patient's strength for his own battle with the infection.

This is achieved by rest, consideration of the diet and good nursing.

Bed. Certainly during the febrile exacerbations and during the period of pain the patient should be kept in bed and will undoubtedly be willing, but during the remissions an insistency on the bed may not be feasible, but a maximum amount of quiet should be enjoined.

Each febrile period is considerably prolonged and the bed should be chosen with a view to comfort and convenience as in Typhoid Fever. (See Chap. V.)

In a state of so great discomfort good nursing counts for much; quiet should be secured, every annoyance avoided and the bed-pan be insisted upon.

The room should be cool and shady and screened against insects.

The urine and feces which contain the organisms should be destroyed, and clothes, bed-clothes and utensils sterilized as in Typhoid Fever cases.

Nurses and physicians appreciating the mode of infection should guard against it by wearing gloves when handling contaminated objects and carefully clean their hands. The rules given under Typhoid Fever serve here. (See Chap. V.)

Care of the Body. Sponge baths with soap and water, talcum powders, alcohol rubs, frequent changing of position keep the skin in condition and avoid bed sores. The mouth and nose should be kept free from secretions, the tongue and teeth especially looked after.

It has been advised, on account of the neuralgias and joint pains, that just as in rheumatism the clothes next the skin should be of flannel or contain wool, and this the more especially because the perspiration is profuse and, when cotton garments become wet through, chilling of the skin may ensue. Of course frequent change of clothes for the same reason is demanded. For details (see Typhoid Fever, Chap. V).

Diet. The general rule for feeding in fever should be followed (Diet in Acute Infectious Diseases, Chap. II) with a view to caloric needs and that, especially, because the fever is long drawn out. As, however, the gastro-intestinal canal is in an irritable condition in the early days, food should not be forced and should at first consist of diluted milk, with soups, cereal waters and jellies, and meat broths (if desired) which may be thickened with cereals or farinaceous meals to enhance their food values.

Goat's milk should not be used, but if deemed imperative it should be boiled or at the least be pasteurized to kill any micrococci melitenses that may be present.

Drinks. Water, saline waters or drinks containing fruit juices should be given freely.

Bowels. The bowels should be freely opened at the beginning with calomel and salts or salines alone, Calomel gr. iii to v (0.2–0.35 Gm) followed by Epsom or Rochelle salts ℥ss to i (15–30 Gm). The calomel may be given in divided doses of gr. ¼ (0.015 Gm) every ten to fifteen minutes for eight or ten doses.

Constipation is the rule throughout the disease and the use of enemata or drugs can not be dispensed with. Calomel has been much used because in addition to its cathartic action it has been assumed to exert a good effect upon the disease itself and jalap for the same reason.

Of course this usage rests on individual opinion and not on a rational basis.

Better for this purpose it seems to me are the milder salines, citrate of magnesia, Hunyadi water and the like, cascara, compound licorice powder, aloin and occasionally more drastic salines like Epsom, Rochelle or Glauber's salts or castor oil.

Retention of urine sometimes occurs and should be looked for. Hot fomentations to the hypogastrium or the sound of running water may relieve this; if not the catheter must be used with all due caution to present infection.

Specific treatment has as yet been illy developed; vaccines have been used in the more chronic forms of the disease and good results have been reported. It would seem a legitimate field of endeavor, but their use should not be undertaken in the acute manifestations of the disorder except by men well versed in the theory and application of vaccine therapy, as real harm may be done.

In the suitable cases the dosage has been 5,000,000 cocci and the number of doses one to ten (Basset-Smith). Some use as high as 50,000,000.

Symptomatic Treatment. The discomforts of the disease are so great that a considerable demand is made on medical procedure.

Pain. Neuralgic pains, joint pains, backache and headache are constant and characteristic phenomena.

When it is possible the measures of physical therapy should be given preference, such as the ice-bag to the head, hot cloths to the back and joints or mustard plasters or poultices or massage or light rubbing with or without liniments and counter-irritants such as chloroform liniment or a 10–15 per cent. methyl-salicylate or menthol or the two combined.

The joints should be treated as in rheumatism, swathed in cotton batten or flannel and if it affords more comfort, mobilized. (See Rheumatic Fever, Chap. III.)

If drugs are used, one may try aspirin or other form of salicylate in doses of gr. x– gr. xv (0.65–1 Gm) every two hours or coal tars, phenacetin gr. iv to gr. viii (0.25–0.5 Gm) at the same intervals or acetanilid gr. ii to gr. iv (0.15–0.25 Gm).

These drugs, however, have been very disappointing and in the severest cases morphin has to be used.

Fever. When within proper limits, 104° F. or less, this requires no other treatment than that directed at comfort such as follows a cool sponge bath; but in hyperpyrexia 105° F. or above or even 104° F. or less, when very sustained, measures aimed at it should be pursued and none are comparable to cold water.

The procedures and their details when there is sutained fever will be found under Typhoid Fever (see Chap. IV) and may be adapted in regard to temperature, length and frequency of bath and, indeed, in all particulars. In cases of sudden high temperature the rules given under "Rheumatic Fever" (Chap. III) should be followed. Hyperpyrexia is one of the real dangers of the disease and should be watched for and provision made for prompt treatment. When cold water can not be obtained, antipyretics may be used but they are illy efficient and dangerously depressant. In the lower temperatures they should not be used.

Vomiting. During vomiting food should be stopped or if the vomiting is persistent give small quantities of egg albumin, beef-juice, or milk peptonized or diluted in water or cereal water. Champagne is sometimes well borne, lessens vomiting and furnishes a little fuel in its alcohol content.

Cracked ice may be used, mustard paste 1 to 3 or 4, or mustard leaf may be applied to the pit of the stomach, bismuth gr. xv to gr. xxx (1–2 Gm), bicarbonate of soda gr. x to gr. xv (0.65–1 Gm), cerium oxalate gr. v to gr. x (0.35–0.65 Gm) may be given singly or in combination.

In very severe cases cocaine hydrochlorate gr. ⅕ (0.012 Gm) may be of value, or calomel in gr. ⅒ (0.006 Gm) doses, or if exhaustion threatens morphine sulphate gr. ⅛ to gr. ¼ (0.008–0.015 Gm) hypodermically.

Sleeplessness may require bromides in early evening in gr. xxx (2 Gm) doses or trional gr. x to gr. xx (0.65–1.35 Gm) or chloralamid gr. xv to gr. xxx (1–2 Gm) or in prolonged or persistent sacrifice of sleep chloral gr. x to gr. xv (0.65–1 Gm) or even morphine gr. ⅛ (0.008 Gm) hypodermically.

Toxæmia. If this is marked the hydrotherapeutic measures mentioned under hyperpyrexia will be found most efficient.

If the circulation is threatened digitalis should be given in doses of the tincture m. xxx (2 c.c.) three or four times a day for three or four days or the equivalent dose of the infusion ʒss (15 c.c.) or powdered leaf gr. iii (0.2 Gm).

For more immediate effect the vaso-motor stimulants caffeine in soluble form, double salt of sodium salicylate or benzoate gr. v (0.35 Gm) every four or every two hours intramuscularly or camphor gr. v (0.35 Gm) in oil, 10 per cent. by the same method at the same intervals.

Orchitis. Is not an uncommon complication. It is to be treated like orchitis from other causes. The testicle is supported, hot fomentations applied or "dry poultices," i.e., a heavy non-absorbent cotton dressing and counter-irritants used, of which light application of the actual cautery is the best. (See Parotitis, Chap. XV.)

Convalescence. Fresh air and plenty of good food are the best tonics during convalescence, though iron as carbonate gr. ii to gr. v (0.15–0.35 Gm), arsenic gr. 1/40 to gr. 1/30 (0.0015–0.002 Gm) and strychnine gr. 1/40 to gr. 1/30 (0.0015–0.002 Gm) may be used singly or in combination.

Prognosis is good, the mortality is only about 2 per cent. to 3 per cent. and immunity against a second attack is probably conferred.

Prophylaxis. The etiology makes the problem clear.

The infected goat should be eliminated from the herd, and tests made of herds in infected districts from time to time. When this is not possible the goat's milk in infected districts should not be drunk or at least should be boiled or pasteurized before using.

Knowledge should be disseminated in infected districts of the possibility of infection from handling the goat, whose urine, feces and milk excrete the organism.

Care should be taken lest the water supply or food be contaminated by the excreta.

Filth harbors the infection while sunlight readily kills the micrococcus; hence, the importance of cleanliness and light.

The patient's excreta, too, containing the micrococci are sources of infection and should be properly disposed of as mentioned above.

It is well to screen the windows and doors against insects that may bear infected excreta on their bodies to food; for by food the disease is nearly always conveyed.

As in typhoid fever some of the patients become carriers after convalescence and have been shown to excrete the micrococci for two years.

SUMMARY

Rest.

In bed; certainly, during exacerbations.

Bed.

For technique of bed-making, see Typhoid Fever, Chap. V, or Dysentery, Chap. VII.

Room.

- Cool and shady. Screen against flies.
- Urine, stools, bed-clothes, utensils, etc. (See Typhoid Fever, Chap. V.)

Physicians and Nurses.

- Should wear gloves in handling secretions.
- (See Typhoid Fever, Chap. V.)

Care of the body.

- Sponge baths, daily, with soap and water.
- Talcum powder.
- Alcohol rubs.
- Frequent change of position.
- Mouth, teeth, etc.
  - (See Pneumonia, Chap. IV.)
- Woolen next skin on account of neuralgias, joint pains and abundant perspiration.

Diet.

- Early days.
  - Diluted cow's milk (not goat's), soups, cereals, jellies, broths thickened with cereals or farinaceous flours.
- Drinks.
  - Water, mineral waters, lemonade, orangeade, grape-juice, Imperial drinks, freely.

Bowels.

- In the beginning.
  - Calomel gr. iii to gr. v (0.20–0.30 Gm) or in divided doses, followed by salts, Epsom or Rochelle ℥ss–℥i (15–30 Gm) or salts may be given alone.
- Throughout the disease constipation is the rule.
  - Calomel.
  - Citrate of magnesia.
  - Hunyadi water.
  - Cascara, e.g., fluid extract m. xv to m. xlv (1–3 c.c.) in water.
  - Compound licorice powder ʒss to ʒii (2–8 Gm) given in water.
  - Aloin, gr. ss to gr. i (0.030–0.060 Gm).

Retention of urine.

- Hot fomentations to epigastrium.
- (For technique, see Typhoid Fever, Chap. V.)
- Sound of running water.
- Catheterize.

Specific treatment.

- (See text.)

Treatment of symptoms.

- Pain and neuralgias.
  - Ice bag to head for headache.
  - Fomentations to back and joints or mustard plasters.

        - Poultices.
        - Chloroform liniment.
        - Methyl salicylate and menthol 15 per cent. in vaseline.
        - Aspirin gr. x to gr. xv (0.60–1 Gm) every two hours.
        - Phenacetin gr. iv to gr. viii (0.25–0.50 Gm) every two hours.
        - Acetanilid gr. ii to gr. iv (0.120–0.25 Gm) every two hours.
        - Very severe.
            - Morphine gr. 1/8 to gr. 1/4 (0.008–0.015 Gm).
    - Fever.
        - Cold water, sponges, packs, baths.
        - (For technique of bath, see Typhoid Fever, Chap. V.)
    - Vomiting.
        - Cracked ice to suck.
        - Mustard paste to epigastrium.
        - (For technique, see index.)
        - Bismuth subnitrate gr. xv to gr. xxx (1–2 Gm).
        - Sodium bicarbonate gr. x to gr. xv (0.60–1 Gm).
        - Cerium oxalate gr. v to gr. x (0.30–0.60 Gm) or combination of above drugs.
        - Very severe.
            - Cocaine hydrochlorate gr. 1/5 (0.012 Gm).
        - If exhaustion threatens.
            - Morphine sulphate gr. 1/8 to gr. 1/4 (0.008–0.015 Gm) hypodermically.
    - Sleeplessness.
        - Bromides gr. xxx (2 Gm) in water in early evening.
        - Trional gr. x to gr. xx in warm water, in whiskey, in powder.
        - Chloralamid gr. xv to gr. xxx (1–2 Gm) in cold water, in whiskey or in powder.
        - If more resistant.
            - Chloral gr. x to gr. xv (0.65–1 Gm) in water.
            - Morphine gr. 1/8 (0.008 Gm) hypodermically.
    - Toxæmia.
        - Circulation.
            - (See Pneumonia, Chap. IV.)

Complication.

- Orchitis.
    - (See Parotitis, Chap. XV.)

Convalescence.

- Fresh air.
- Good food.
- Iron.
- Arsenic.

Prophylaxis.

- Elimination of infected goats.
- Herds tested.
- Milk should not be drunk.
- Instruction in regard to the infectivity of milk, urine and feces of infected goats.

Care of the water and food supply.
Disinfection of patient's excretions.
Screen room of patient against insects.
Determination of "carriers."

CHAPTER XXVI

LEPROSY

To no other unfortunate has the term "unclean" clung throughout the ages so insistently as to the leper.

Its importance to us is that it has invaded North America and while its distribution is not so uniform as is the case with most of the infectious diseases, still its distribution is no respecter of climate and in our own country it is found in Minnesota in the North and Louisiana in the South, just as abroad it finds residence in the cold of Norway and the heart of India. Fortunately in this country the numbers are not large nor the spread rapid, still its mutilations carry no less horror to-day than in biblical times, even though more knowledge protects the community from unreasoning fear and the unfortunate from ill-usage. At least we have fixed the cause in a definite organism, the bacillus lepræ and learned something of its habits[1] and the present time is witnessing no inconsiderable impulse to investigation in this field among our own workers.

Three facts of practical importance about bacillus lepræ are, first, that in all possibility its portal of entry into the human organism is the naso-pharynx, second, that it is discharged by way of all the secretions including discharges from sores, and thirdly, that it is peculiarly tenacious of life even in an adverse environment.

The organisms infect all the organs and tissues but have a peculiar predilection for the skin and peripheral nerves and the clinical picture depends on which of these structures is predominatingly affected.

Isolation. The isolation of the leper has been throughout the ages the fruit of experience and recent pleas to free the leper in the community meet with prompt rebuttal in facts educed by a study of his distribution of the infecting germs.

Colonization is the modern method of isolation; a colonization directed by every humane effort to relieve this life-long divorcement from the world.

Precautions of Attendants. It is essential for all who come in contact with the patients to know that the bacilli of leprosy have been found in all the secretions, urine, feces, sweat, milk, sputum, in the secretions from the nose, the vagina, the urethra, as well as in the secretions and pus of sores and that all these secretions should be destroyed by burning or, when contaminating useful articles, by boiling or by powerful antiseptics. It should be particularly remembered that the lesions are apt to be early and severe in the upper air passages and that this may be conveyed by the spray of a sneeze or a cough or even in talking. Again it is to be remembered that the bacilli are peculiarly insistent and will remain virulent for months in dried secretions and in soiled linen.

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[1] Strong in Forchheimer's *Therapeusis of Internal Diseases* would imply that identification of the organism of Leprosy is by no means certain.

It must be borne in mind, too, that insects may be the means of conveying infection and that non-infected animals may become carriers. That the disease is not lightly infectious is shown by the fact that long contact with infected persons seems necessary for its conveyance.

Cleanliness of the skin, the mouth and nose, sufficiency of good well-cooked food and, in short, careful consideration of the rules of health are doubly important to those exposed to the disease.

Leprosy is a curable disease and that always means that it is the body's own forces that must be called upon. This knowledge accentuates the importance of diet and hygiene, measures that contribute to the body's efficiency.

The fight is a long one and the improvement slow, in this respect like tuberculosis; and so, as in the latter disease, all efforts in the patient's behalf must be persistent.

Diet. After all it is from the food that all the energy used by the body must come, for the production of immune bodies as well as for other purposes; consequently, it should be abundant, well selected as to quality and well prepared.

Fresh Air. The life of the leper like that of the tubercular should practically be in the open, the same provision being made for sleeping out of doors.

Baths. Cleanliness is most important and baths not only keep the pores of the skin open and subserve the functions of that structure, but they have a tonic effect on the nervous system and, when the lesions of the skin are pronounced, serve as a vehicle for suitable medication.

Hot baths are found especially grateful.

Such supportive treatment is of infinitely greater value than any empirics or specifics that we have at our command.

Empirical Treatment. An empiricism means merely a groping; the drugs that find favor are legion and none very satisfactory. Of all the drugs yet employed there is greater agreement on the value of Chaulmoogra oil than on any other.

Chaulmoogra Oil (Oleum gynocardiæ). This oil is expressed from the seeds of the gynocardia odorata.

Mode of Administration. It has been given by the mouth, by the rectum, hypodermically and applied to the skin. By far the most common method is by the mouth.

Dosage. The amount given must be considerable to be effective; but, as it is illy borne at first by the stomach, the initial dose should be small and gradually increased.

It is well to begin with 3 or 4 drops at a dose three times a day and increase a drop or two to the dose every three or four days until the limit of tolerance is reached or the dose totals 100 to 130 drops three times a day. The limit of tolerance is determined by the stomach's irritability.

It is perhaps better given before meals, using as vehicles hot coffee, hot milk, cordials or milk of magnesia or it may be given in capsules or in pill-form, although the administration by these last two methods would be feasible only at the beginning.

It has always seemed to me undesirable to give a disagreeable or disagreeing medicine in food, lest a distaste for a useful food be acquired by association.

By Rectum. It has been so administered in milk as a vehicle, but this would scarcely be the preferred route.

Hypodermically. Some irritation may ensue from the oil used in this manner, but when sterilized by heat this is said to be, for the most part or quite, avoided.

The oil so treated as to lessen its irritating qualities has been brought forward under the name of "anti-lepral."

It is said to be less irritating to the stomach. As much as 5 c.c. a day for months has been tolerated when so given.

Externally. Chaulmoogra oil diluted to 5 per cent. to 10 per cent. with some bland oil has been used as an inunction.

Two rubbings a day are given. Latham and English's system of Treatment gives the following formula for its local use. Chaulmoogra, 4; soft parafin, 6; hard parafin, 1.

There can be no doubt that the rubbing itself would be beneficial to the infiltrated or anæsthetic skin, but as compared with its dose by the mouth this and other methods are of dubious value; nothing is known of its modus operandi in cases which improve, beyond the fact that as fat it has some food value.

The disadvantages in its use rest upon its irritating action on the gastro-intestinal canal which induce vomiting and diarrhea. This seems not difficult to avoid if care be taken in its administration.

Opinions differ about its value. Dyer, whose experience in Louisiana, where it is endemic gives him authority, speaks highly of it in Osler's *Modern Medicine,* and reports twelve cures in his own experience since 1894. Wooley on the other hand grants no gain to its use and believes improvement due to a better appetite and better functioning of the skin following its use, such as follow certain systems of baths.

It must be said, however, that the results of this treatment have made a considerable impression on most men who have employed it and is perhaps the best weapon at hand at the present moment.

Other Drugs. Among other drugs of less repute are **Nastin,** a bacterial fat which is diluted in benzoylchloride to lessen its irritative effects to the strength of .05 per cent., called Nastin B, and to .2 per cent. Nastin B_2.

One c.c. subcutaneously once a week for five or six weeks is used of the weaker dilution, then is followed by weekly injections of the stronger. This has its advocates but elicits no such commendation as the Chaulmoogra oil.

Calmette's Serum. Dyer attracted by the belief among certain West Indians that the bite of certain reptiles cured leprosy, used Calmette's Antivenomous Serum in doses of 5 c.c. to 20 c.c. under the skin, sometimes as often as every day and found excellent results, reporting three cures.

Specific Treatment. Very naturally in this day of serum and vaccine therapy efforts have been made to utilize the products of bacterial action to enhance the production of immune bodies, and naturally there have been many disappointments. Among the later efforts and one giving some promise is a toxin derived from the bacillus lepræ by Rost and called "leprolin."

Its use, of course, attempts an active immunization. Its dose is 10 c.c. given intravenously at two to three day intervals and further dosage determined as in the use of tuberculin or vaccines, by the reactions induced.

It is said to be contraindicated in the presence of pulmonary or kidney complications.

It is hardly fair as yet to draw conclusions, but judicial clinicians seem to be optimistically inclined toward it.

Tonic Treatment. More or less emphasis is laid on the value of tonics and strychnine or nux vomica, arsenic, phosphates and iron are used as in other conditions which are believed to indicate their use.

Surgical treatment is indicated towards the sores and mutilations that demand removal of diseased tissue in skin or bone; amputations, excision of nodules, stretching of nerves for pain, etc.

X-Ray treatment is said to reduce the size of the tubercles.

Prognosis. So evil a reputation has leprosy borne throughout all history that the impression one receives of the prognosis is of the worst; and yet a study of the disease shows that it is self-limited at any stage and that a mode of life aimed at improving the general health quickens the process of cure more than anything else can do.

That death or mutilation is the final issue in most of the cases, however, is all too true.

Prophylaxis to the community consists in isolation; to the individual in avoidance of contact with the secretions and discharges.

It has long been noted that long contact seems necessary for infection. Extremely interesting results bearing on this fact have followed upon the work of Duval and Gurd on animals. I quote from their article: "Two factors are of great importance in effecting infection. In the first place, a sufficiently large number of organisms must be employed, and, what is still more important, second and subsequent inoculations are more liable to produce leprous lesions than are the primary injections.

"Such preliminary doses, whether they consist of living or dead organisms, produce a condition of hypersensitiveness or allergy which renders it possible by a second injection of viable bacilli to induce the development of a reactionary lesion. Lesions arising as the result of a second inoculation develop more rapidly, increase in size more quickly, and persist for a longer period than those taking place as the result of a single inoculation, even though very large doses are used. Moreover, the bacilli in these lesions are more liable to lead to metastasis and to a generalized infection. We regard the results of these experiments as having considerable bearing upon the development of the disease in human cases, since we find that it is chiefly among those living in prolonged intimate contact with leprous patients that leprosy develops." (*Journal of Experimental Medicine,* Aug. 1, 1911.)

I have already spoken of the danger to those in contact with patients that arise from secretions, discharges and spraying of coughing, sneezing, etc., and how these secretions should be disposed of. That the naso-pharynx is probably the portal of entry accentuates the precautions that should be taken not to carry the infection by the hands to this locality. The possibility of infection by way of the skin by minute traumata or bites of insects must not be forgotten.

It would seem almost unnecessary to mention the dangers attendant on marriage, and the precautions that should be taken in the employment of nurses, wet nurses or others coming into close contact with members of a household who live in an area where leprosy is endemic.

Another fact of importance is the remarkable viability of the bacilli lepræ, which will survive for months or years in a locality once inhabited by a leper. This makes disinfection of houses and articles subjected to contamination doubly imperative and demands thoroughness. It also emphasizes the importance of colonization.

The dead should be cremated; for the leper bacillus has been found viable months after burial.

SUMMARY

Isolation.

By colonization the common method.

All secretions and excretions, urine, feces, sweat, milk, sputum, those from the nose, vagina, urethra, all contain the bacillus and should be destroyed by fire or antiseptics. (See Typhoid Fever, Chap. V.)

Attendants must remember that the spray of sneezing, coughing and talking can convey the organism.

Insects can convey infection.

Attendants must give especial attention to their personal hygiene.

Diet.

Must be sufficient.

Fresh air.

Life in the open; sleep in open air.

Skin.

Must be kept clean by daily baths.

Empirical treatment.

- Chaulmoogra oil.
  - Dose.
    - Three or four drops three times a day. Increase a drop or two every three to four days until 100 to 130 drops three times a day are given or until irritability of the stomach prevents. May be given in hot coffee, cordials, milk of magnesia, hot milk, capsules; best before meals.
- Hypodermically.
- External use.
- Other drugs and measures.
  - Nastin. } (See text.)
  - Calmette's Serum. } (See text.)

Specific treatment.

Leprolin, 10 c.c. intravenously every two to three days.

Tonic treatment.

- Strychnine or Nux Vomica.
- Iron.
- Arsenic.
- Phosphates.

Surgical treatment. } (See text.)
X-Ray treatment. } (See text.)

Prophylaxis.

- Isolation.
- Avoid contact with secretions and discharges.
- Thorough disinfection of all objects in contact with a case of leprosy.
- Dead should be cremated.

CHAPTER XXVII

ANTHRAX

ANTHRAX is a disease that affects peculiarly domestic animals, the horse, cattle, sheep and goats.

The causative agent is the bacillus anthracis, a large spore-bearing organism, and the first shown to have causative relationship to an infectious disease.

The disease is conveyed to man through contact with animals or their secretions.

It may enter and infect the skin through minute wounds or abrasions, so is most likely to occur on exposed surfaces and in individuals handling the sick animals, their carcasses or hides, such as drovers, butchers, porters of hides, wool sorters, tanners, etc.

The skin, too, may be inoculated by the bite of the stable-fly.

The lesion is called "malignant pustule." At first a papule, then vesicles and pustules, soon with deep and extensive involvement of the subjacent and adjacent tissues, appear.

Characteristic is the freedom from pain, in spite of the extensive infiltration. Sooner or later, depending on the virulency, the symptoms of greater infection follow.

On the other hand it may enter the body through the air passages or by way of the mouth. Infection of the lungs occurs so commonly among one class of workers that their occupation has given a name to the disease, the "wool-sorter's disease," due, of course, to inhalation of spores borne in the dust raised by their work in the wool.

The course is rapid; two, three or four days. The symptoms point to an involvement of the lungs but neither subjective nor objective signs are characteristic. Rapid asthenia sets in, followed by death.

When the infection is by way of the mouth the intestine is affected. This usually occurs through eating of infected and improperly cooked meat or drinking infected milk. This form is rare in man. It is manifested by stormy gastro-intestinal symptoms that resemble a poisoning or may simulate intestinal obstruction.

One speaks of it as "Intestinal Anthrax." Death follows in two to six days.

Treatment. The treatment aims at supporting the patient's strength, as in any other infection, the use of specific remedies, the treatment of the local lesion and the relief of symptoms.

As it is only the external form of infection that we can hope to attack with success and that only when seen early, we will begin with a consideration of the local treatment.

Local Treatment. This is distinctly a surgical problem. It would seem to me that a lesion rife with such fatal possibilities as malignant pustule should have the most radical treatment and that complete excision going well wide of the lesion out into the sound tissues should be practiced. It is universally advised that, in addition, the open wound should be thoroughly cauterized with pure phenol (liquified carbolic acid) or with actual cautery. In addition, some authors advise injections of carbolic acid into the tissues at several points around the area of excision, as the bacilli on their way to the lymphatics may be harbored there. It may be used in 3 per cent. watery solution. Others prefer pure carbolic acid as less likely to be absorbed from the site of injection.

Carbolic Acid. Carbolic acid has been used, too, around the site of the infection and as originally recommended, as often as every hour or even more frequently, 10 to 15 minims of the 3 per cent. watery solution or even the pure phenol.

Hot poultices are applied to the infected area.

Bloodgood and McGlannan favor this treatment when excision will result in much mutilation.

As another caustic, **caustic potash** has been recommended.

The wound is dressed with a wet dressing.

Specific Treatment. Serum from immunized sheep or asses has been used in the treatment of animals and more lately of man. In the cases reported 30 to 40 c.c. of the serum was used daily both intravenously and subcutaneously.

The results reported certainly make the use of the serum imperative, the mortality having been lowered to 6 per cent. or less.

When constitutional symptoms are manifest, as they are from the beginning in internal anthrax and as they are after a greater or less period in malignant pustule, **supportive treatment** should be vigorously begun.

This, of course, means rest in bed in a room chosen with a view to convenience and ventilation and one where isolation may be maintained.

If this room is accessible to porch, verandah, or lawn, where open-air treatment may be maintained, it is a distinct advantage.

The body should have proper attention, such as baths for cleanliness, care of mouth, nose, genitals, attention to pressure points, in other words all that pertains to good nursing. (See Typhoid Fever or Pneumonia.)

Especial attention should be given to the destruction of discharges from the pustules and the secretions and the excretions of the body, which contain the anthrax bacilli.

The **diet** should be sufficient and based on the same considerations as determine the dietary in other acute infections. (See Diet in Acute Febrile Conditions, Chap. II.)

The severity and stormy course of the infection in internal anthrax and the violence of gastro-intestinal symptoms in the intestinal form of anthrax, will, of course, modify these rules considerably.

Symptomatic Treatment. The temperature is rarely high and requires no consideration, *per se.*

Sooner or later the circulation begins to wane and stimulation becomes necessary. To the failure of vaso-motor centers such drugs as **caffeine** or **camphor** are directed, in doses of gr. v (0.33 Gm) at two to four hour intervals, the former as a soluble salt of sodium salicylate or benzoate and the latter in oil, 10 per cent. Both are used under the skin or better still into the muscle.

Strychnine may also be used in doses of gr. $\frac{1}{40}$ to gr. $\frac{1}{30}$ (0.0015–0.002 Gm) at three to four hour intervals.

To support the heart, digitalis in sufficient doses gr. ix to gr. xii (0.6–0.8 Gm) a day of the leaf or its equivalent of the tincture ʒiss to ii (6–8 c.c.) or of the infusion fresh ℥iss–ii (45–60 c.c.) or if the need is urgent strophanthin into muscle or vein gr. $\frac{1}{120}$–gr. $\frac{1}{60}$, mg. $\frac{1}{2}$ to 1, followed by digitalis.

Headache may be relieved by the ice-bag, restlessness and **sleeplessness** by codeine gr. $\frac{1}{4}$ to gr. ss (0.015–0.030 Gm) or morphine sulphate gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$ (0.008–0.015 Gm) or in insomnia chloral gr. x to gr. xv (0.66–1 Gm).

Vomiting will require cessation of food or small quantities of liquid food, cracked ice, soda or bismuth in gr. x. to gr. xv (0.66–1 Gm) doses or oxalate of cerium gr. v to gr. x (0.33–0.66 Gm) or a combination.

Diarrhea will need the administration of large doses of bismuth gr. xxx to gr. lx (2–4 Gm) every two hours, or opium gr. $\frac{1}{4}$ to gr. ss (0.015–0.03 Gm) at the same interval or starch enema with opium as tincture m. x to m. xv (0.66–1. c.c.).

Delirium will demand restraint, the use of morphine or chloral in doses given or hyoscine gr. $\frac{1}{150}$ to gr. $\frac{1}{100}$ (0.00045–0.0006 Gm).

Convulsions demand the use of inhalations of chloroform during the attack and morphine and chloral between.

Prophylaxis. Successful stamping out of the disease in man can only be accomplished by stamping it out in animals.

Infected animals should be killed and remembering that the spores are peculiarly resistant and that they are ærobic it is important to disturb the carcasses as little as possible and to bury them deep.

This same resistance or the spores and the fact that they are excreted in urine and feces make it difficult to stamp the disease out of the fields in which the infected animals have been pastured.

It must be remembered, too, that these fields are a menace to healthy animals.

SUMMARY

Treatment of malignant pustule.

Complete excision, well out into sound tissue.
Cauterize this open wound with pure phenol (liquified carbolic acid) or with
Actual cautery.
Carbolic acid either pure or m. x to m. xv (0.60–1 c.c.) of 3 per cent. watery solution has been injected all about the excised area.
Another method—Injections of phenol as above about site of infection. Poultice to the infected area (Bloodgood and McGlannan). Wound is dressed with wet dressing.
Specific treatment.
  Serum 30 to 40 c.c. daily under the skin or into vein.
When constitutional symptoms are manifest.
  Rest in bed.

Room.

Cool, light, well ventilated.

Bed.

Hospital type.

Care of body.

Daily bath.
Mouth.
Nose.
Genitals.
Bed sores.
} (See Typhoid Fever, Chap. V, or Pneumonia, Chap. IV.)
Discharges from pustules, secretions and excretions must be destroyed by fire or disinfected. (See Typhoid Fever, Chap. V.)

Diet.

(See Chap. II.)

Circulation.

Digitalis.
Strophanthin.
Caffeine.
Camphor.
Strychnine.
(See text, or Pneumonia, Chap. IV.)

Headache.

Ice bag.

Restlessness and sleeplessness.

Codeine, gr. 1/8–gr. 1/4 (0.008–0.015 Gm).
Morphine, gr. 1/8–gr. 1/4 (0.008–0.015 Gm).
Chloral, gr. x–gr. xv (0.60–1 Gm).

Vomiting.

Stop food.
Cracked ice.
Mustard paste to epigastrium.
Bismuth subnitrate, gr. xv (1 Gm).
Sodii bicarbonate, gr. x (0.60 Gm).
Cerium oxalate, gr. v (0.30 Gm).

Diarrhea.

Bismuth subnitrate, gr. xxx–ʒi (2–4 Gm) every two hours.
Opium, gr. $\frac{1}{4}$ (0.015 Gm) every two hours.
Starch enema with tincture of opium m. x–m. xv (0.60–1 c.c.).

Delirium.

Restraint.
  Morphine, gr. $\frac{1}{8}$–gr. $\frac{1}{4}$ (0.008–0.015 Gm).
  Chloral, gr. xv (1 Gm).
  Hyoscine hydrobromate, gr. $\frac{1}{200}$–$\frac{1}{150}$ (0.0003–0.00045 Gm).

Prophylaxis.

Kill infected animals and bury their bodies deep.
Avoid use of infected fields.

CHAPTER XXVIII

GLANDERS OR FARCY

THIS disease is peculiarly common among horses and the horse kind, and is communicated by them to man; so that it is in hostlers, drivers, farmers and others in intimate contact with the horse, the mule or the ass that the disease is found.

The causative agent is the bacillus mallei, which is found in the purulent discharges and in the secretions from the infected mucous membranes and is inoculated into the air-passages or skin abrasions in man. There is a difference of opinion as to whether it may enter through the unbroken skin.

When the infection is received through the air-passages and the lesion is internal it is called Glanders; when through the skin and the lesion is external it is called Farcy.

The local effect of the bacillus is the formation of nodules of an inflammatory character, which break down and form pustules and ulcers, whose discharges carry the infection.

The disease may run either an acute or chronic course; so that we have Acute or Chronic Glanders and Acute or Chronic Farcy.

Treatment. The disease is a toxæmia with local manifestations and the treatment that which is applicable to all infections, i.e., measures aiming at the support of the body in its contention with the disease, specific treatment, if there be any, attention to the local lesion and relief of distressing or dangerous symptoms.

For the first, rest in bed, with consideration for all that constitutes rest, good nursing, good room, quiet and mental rest, a sufficiency of diet and fresh air, preferably in the open, meet these demands. (See Treatment of Acute Febrile Conditions and Diet in Fever, Chapters I and II.)

The mortality of the disease is high, but, as would be expected, least in the chronic form and when confined to the surface of the body, chronic farcy.

Chronic Farcy. The picture is that of a pyæmia, in which the local lesion may precede or follow the toxæmia, with, sooner or later, multiple abscesses, ulcers and fistulæ slow in progress and perhaps with improvement followed by relapse, and death from emaciation, asthenia and overwhelming by poisons or at any time acute glanders intervenes and hastens the fatal issue.

Besides the supportive treatment specified above one turns to the use of those substances that in a sense may be termed **specific**, as contributing to Nature's own efforts and in the same terms.

Unfortunately, the results are but little encouraging, and yet any assistance in so dread an infection is welcome. Of such agents one may mention mallein.

Mallein is a toxin obtained from the bacillus mallei much as tuberculin from the tubercle bacillus and has many parallelisms with the latter.

Its particular usage is as a test for the presence of the infection, used like tuberculin for a kindred purpose and provoking like the latter in a true case a febrile response and a local reaction.

Like tuberculin, too, it has been suggested as a curative agent, provoking in graduated doses increasing response in the tissues in terms of immune bodies. Definite rules of dosage cannot be laid down, but advice should be sought from State or Municipal Laboratories preparing the same and acquainted with the reaction obtained in animals. Few have used it, and their praise is qualified.

Vaccines. More hopefully one turns to the use of vaccines and though the reports of successful cases are scanty, nevertheless some have been noted by competent observers.

Park (Forchheimer's *Therapeutics of Internal Diseases*) advises 20,000,000 as a beginning dose and gradual increase up to 200,000,000 or more at four or five day intervals. Dosage is governed by reaction as in use of other vaccines; i.e., by fever, local redness about site of injection or lighting up of local lesions.

A moral obligation to familiarize himself with the theory and practice of vaccine therapy rests on the man who uses an agent, which used carelessly is potent to convert a local process into a hopeless general one. (For words of warning, see Theobald Smith, *Jour. Am. Med. Association,* May 24, 1913.)

Serum reactions, used as diagnostic tests, such as the agglutination test and the complement fixation test bespeak the presence of immune bodies, which together with the results in establishing immunity in animals by vaccines encourage the use of serum of immunized animals as a curative agent but unhappily the hope elicited has not been sustained.

Treatment of the Local Lesions. The word of warning not to convert a local lesion into a generalized infection has been well given, for too vigorous curettage or rough handling may break down or thin the walls of abscess or ulcer, nature's barriers, to the defeat of her intent to localize the infection by these means.

Abscesses as in other conditions should be incised and evacuated, thoroughly irrigated and a strong antiseptic applied, but not roughly rubbed about.

Pure carbolic is a suitable substance and this may be followed by alcohol to remove the excess. Wet dressings of **bichloride** may be used or **iodoform** gauze or tincture of iodine and a light packing of gauze to keep the wound open.

Ravenel in Osler's *Modern Medicine* advises as a caustic a 1 to 10 solution of **chloride of lime.**

If the lesion is small and well localized excision is advisable.

Chronic Glanders. Less hopeful than chronic farcy, indeed, almost hopeless is this condition in which the upper air-passages and the lungs are involved, coming on in the majority of cases as a result of the chronic farcy.

The **treatment** is, of course, the same, except that not as much can be expected from the vaccines and still less from the use of mallein.

The **nose** with its ulcerations, necrosis of bones and sinus involvement calls for local treatment, irrigations of saline solutions, boric acid or in the case of much necrotic tissue irrigations with permanganate of potash solution, of a deep claret color or applications of peroxide of hydrogen. Insufflations of iodoform have been suggested.

The annoying cough may be alleviated by inhalations of steam or medicated with compound tincture of benzoin, oil of pine, creosote, or eucalyptus. A teaspoonful or two may be added to the inhaler or a perforated zinc inhaler (Robinson's) may be worn over nose and mouth with some mixture as creosote, chloroform and alcohol equal parts, 10 to 15 drops on the sponge of the inhaler. Later codeine sulphate or phosphate in doses of gr. 1/8 to gr. 1/2 (0.008–0.030 Gm) at two or three hour intervals may be demanded and still later and especially with the distressing dyspnœa morphine gr. 1/12 to gr. 1/8 (0.005–0.008 Gm) at four hour intervals.

Acute Farcy. Here both local and general symptoms are so severe that life is despaired of. The picture is one of acute septic poisoning, and intense local infection, erysipelatous or forming ulcers, like gangrene and wide spread pustular eruption.

Acute glanders presents the same picture as acute farcy with the additional distress attendant upon involvement of the air-passages.

Beside the **supportive treatment** and relief of symptoms, nothing can be added; for vaccines here can do no good.

Circulatory and **respiratory needs** are met by the use of caffeine, camphor, atropine, digitalis or strophanthin as in other infections, but are used rather with a feeling that an effort to do something is better than *laisser aller;* though from the patient's standpoint that is doubtful.

Doctor and nurse should remember that the discharges of the patient are infectious and take precautions accordingly, by burning all discharges and thoroughly sterilizing by heat or strong solutions of carbolic acid clothes and linen contaminated with them; by sterilizing the dishes and implements used by the patient. (See Typhoid Fever, Chap. V.) Gloves should be used in doing dressings and handling discharges.

Isolation. Acute cases should be carefully isolated and every warning given of the danger of too close contact even in the chronic cases.

Prophylaxis. As the disease is always conveyed by the horse, the appreciation of the disease in this animal is of first importance and a skillful veterinarian is often necessary to appreciate the latent cases.

These animals should be killed and the stables carefully disinfected and the other horses tested from time to time to detect further infection.

Individuals handling horses known to be infected should use gloves and if inoculation is known to have occurred excision of the site is advised.

SUMMARY

Isolation.

- Must be carefully observed.

Doctors and nurses.

- Should wear gloves.
- Avoid spray of cough.
- Destroy all secretions by burning or disinfecting.
- Disinfect all articles used about the patient.
- (See Typhoid Fever, Chap. V.)

Chronic Farcy.

- Specific treatment.
  - Mallein. (See text.)
- Vaccines.
  - Begin with 20,000,000 and increase up to 150,000,000 or 200,000,000.
  - Give every four or five days.
  - Dosage and frequency governed by reaction.
- Treatment of local lesions.
  - (Read text.)
  - Incise and evacuate.
- Abscess.
  - Irrigate.
  - Apply pure phenol (carbolic acid).
  - Apply alcohol to remove excess of phenol.
  - Pack wound with wet dressing of bichloride, or iodoform gauze.
  - Excise, small, well localized lesions.

Chronic glanders.

- Specific treatment, as above.

Care of nose.

Irrigation with saline, 0.6 per cent. (ʒi to Oi, 4 Gm to 500 c.c.) or 2 per cent. or 4 per cent. boric acid solution.

If much necrosis

- Irrigate with permanganate of potash; make solution of rich claret color.
- Apply peroxide of hydrogen.
- Iodoform, insufflated has been recommended.

Cough.

Inhalations of steam, medicated with

Compound tincture of benzoin.
Oil of pine.
Creosote.
Oil of Eucalyptus.
} ʒi or ii (4–8 c.c.) on the water of an inhaler.

A good prescription is

℞.

Alcohol,
Chloroform,
Creosote,
} equal parts.

S. gtt. v–x on sponge of a Robinson's inhaler (perforated zinc inhaler for nose and mouth).

Codeine sulphate or phosphate, gr. $\frac{1}{8}$ to gr. $\frac{1}{2}$ (0.008–0.030 Gm) every two or three hours.

Morphine sulphate, gr. $\frac{1}{12}$ to gr. $\frac{1}{8}$ (0.005–0.008 Gm) every four hours.

Acute glanders and
Acute farcy

Relief of symptoms, as above.

Circulatory stimulants.

- Digitalis.
- Strophanthin.
- Caffeine.
- Camphor.
- (See Pneumonia, Chap. IV.)

Respiratory stimulants.

- Caffeine.
- Atropine.
- Strychnine.

Prophylaxis.

- Killing of infected horses.
- Disinfecting stables.
- Testing all animals in contact with sick horses.
- Wearing gloves in handling sick horses.
- Excise site of any inoculation.

CHAPTER XXIX

FOOT AND MOUTH DISEASE

This is essentially a disease of animals, but may include man among its victims.

The cause is as yet unknown, no organism proven definitely responsible for the disease having been isolated.

The virus has been shown to pass through a Berkfeld filter; hence, is to be classed as ultramicroscopic.

The incubation period is put in Osler's *Modern Medicine* from two to ten days. It begins in man with a fever and other signs of toxæmia and in two or three days there appears the characteristic vesiculation in the mouth and between the fingers and toes that gives the name to the disease.

With the appearance of the eruption the temperature declines.

Treatment. There is no specific remedy; so the treatment resolves itself into efforts at relieving the effects of the toxæmia and the ulcerations in the mouth and on the skin.

The same principles are applicable in this as in other infectious diseases.

Rest in bed with the choice of a comfortable narrow bed and firm mattress and a room capable of thorough ventilation and accessible to the sun.

Isolation. The disease is contagious, so only those who minister to the needs of the patient should be admitted.

Physicians and nurses should use gloves in handling the patient, treating the ulcers and handling the secretions. These latter should be burned.

Articles coming in contact with the patient such as thermometers, dishes, bed-pans, urinals, bed clothing, should be handled as in other infectious diseases. (See Typhoid Fever, Chap. V.)

Diet. Feeding is difficult on account of the condition of the mouth; the ulcerations affecting it in particular and extending into the pharynx, œsophagus, the larynx and trachea. This, of course, makes chewing and swallowing very difficult.

The food should be liquid or of nearly fluid consistency and concentrated; milk, and milk fortified with milk sugar and cream, say an ounce of each to each glass of milk and soups made of milk and farinaceous flours or cereals, cereal jellies and eggs, may be taken as the basis of such a dietary.

It may be necessary to use the stomach tube or nasal tube or have recourse to rectal feeding, especially in children or illy nourished individuals. Water should be given freely. It must be determined that the milk does not come from infected sources and if there is an element of doubt it should be boiled.

Fever is rarely high or long continued. If any antipyretic measure is used at all, hydrotherapy in the shape of cold sponges offer the only legitimate one.

Daily sponge baths for cleanliness should always be given.

Circulation. Evidences of faltering circulation should be met by the same measures used in other infections. (See Pneumonia, Chap. IV.)

Care of Mouth. This is of the most vital importance for here a fatal sepsis may begin or pain and discomfort sacrifice nutrition to the danger point.

The best means to keep the mouth in condition is by abundant irrigations of warm saline solution (see Scarlet Fever, Chap. IX), or one may use boric acid 2 per cent. or quarter strength Dobell's solution. This should be done after each feeding and it were well to give a small irrigation before a feeding on account of the abundant secretions from the salivary glands gathering in the mouth and on account of the detritus from the ulcers. This is especially important in the morning.

Food must be removed from the dead spaces between the gums and teeth by swabs on wooden toothpicks or other applicators; one of the above solutions are used to moisten the sponges.

The best treatment for the ulcers is to touch each with silver nitrate stick or with small swabs wetted with 25 per cent. to 50 per cent. silver nitrate.

If the mouth is very foul one may irrigate with ⅓ per cent. permanganate of potash or a solution made to a deep claret color.

Chlorate of potash solutions may be used as mouth wash or gargle, 1 per cent. to 2 per cent., or if painful, of lesser strength. The nose, too, must receive similar attention.

Vesicles and Ulcers of Skin. These are usually confined to fingers and toes and region of mouth and nose, but in some cases may be more generally distributed.

The ulcers are usually shallow. Drying powders, like sterile talcum powder, is best used on vesicles and ulcers or such a powder as Aristol on the latter.

It must be remembered that the contents of these blebs are contagious.

Gastro-enteric Symptoms. These at times may be severe with much colicky pain and diarrhea.

A thorough cleaning out with castor oil followed by small doses of the oil m. x (0.65 c.c.) every two hours or by bismuth ʒss (2 Gm) every two hours with local applications of heat to the abdomen may relieve the distress, or small doses of opium may be necessary, m. i (0.06 c.c.) of deodorized tincture, every two hours.

The duration is about two weeks, though it may last somewhat longer.

Death is not a common issue except among sickly children.

Prophylaxis. The disease is transmissible through the contents of the vesicles of diseased animals and through the saliva, also through the milk or the products of milk, e.g., butter, cheese and cream of diseased animals; hence, workers about animals and children drinking the milk are peculiarly prone to contract the disease, and, as might be expected, the mouth is first affected in those drinking the milk. Cattle affected should be killed and a thorough disinfection of the stable, etc., follow.

Suspected milk should not be drunk or should be sterilized and all suspected meat destroyed.

SUMMARY

Treatment.
Local, of ulcerations in mouth and skin.
General, to relieve effects of toxemia.

Rest.
Bed, hospital type preferred.
Room, well ventilated and lighted.
Quiet.
Isolation.
Physicians and nurses wear gloves in handling patient and secretions.
Treatment of objects in contact with patient and of secretions. (See Typhoid Fever, Chap. V.)

Diet.
Liquid or of fluid consistency.
Milk, which may be fortified with sugar or cream.
Soups of milk, cereals, farinaceous flours.
Cereal jellies.
Eggs.
Avoid milk from infected sources, or if in doubt boil it.
May have to use stomach or nasal tube or have recourse to rectal feeding.
Water, give freely.

Bowels.
Initial dose of castor oil ℥ss to i (15–30 c.c.) preferred if there is diarrhea, or salts ℥ss–i (15–30 Gm).

Fever.
Rarely requires interference, or at the most cool sponges.

Circulation.

(See measures used in Pneumonia, Chap. IV.)

Care of mouth.

Abundant irrigations of warm saline (see Scarlet Fever, Chap. IX), or of 2 per cent. boric acid or quarter strength Dobell's solution.

Well to precede feeding by a lesser irrigation; especially in the morning.

Swabs or toothpicks wetted with solutions mentioned to free dead spaces between cheeks and teeth and interstices of teeth from food.

Ulcers of mouth.

Touch with silver nitrate stick or 25 per cent. to 50 per cent. silver nitrate solution.

Chlorate of potash solution, 1 per cent. to 2 per cent., as a mouth wash.

If mouth is foul,

Permanganate solution of a rich claret color (1/3 per cent. solution).

Nose.

Cleansed with saline, boric acid or Dobell's solution.

Vesicles and ulcers of the skin.

Drying powders or Aristol.

Gastro-intestinal symptoms.

Colicky pains.

Hot fomentations.

Diarrhea.

Preliminary dose of

Castor oil ℥ss–i (15–30 c.c.).

Follow by castor oil in small doses, m. x (0.65 c.c.), every two hours.

Bismuth subnitrate,

gr. xxx (2 Gm), every two hours.

If much pain.

Opium, deodorized tincture, m. i (0.06 c.c.) every two hours.

Prophylaxis.

(See text.)

CHAPTER XXX

PSITTACOSIS

This is a disease incurred from parrots, resembling an atypical pneumonia; atypical in its physical signs and in its course, and Osler says characterized by an onset like typhoid fever.

An organism belonging to the hog-cholera group was isolated by Nocard and shown by him to precede the disease in other parrots and other animals.

The incubation has been set as short as a week and as long as three weeks or more.

The diagnosis is made when a case and especially several cases occur in a family where there are sick parrots.

It is to be treated like any pneumonia, especially bronchopneumonia, and the same considerations of choice of room, bed, diet, air and attention to the circulation with relief of annoying symptoms obtain in the one as in the other. (See Pneumonia, Chap. IV.)

The disease in cases that get well runs from two to three weeks. The disease is a severe one as the mortality of 35 per cent. to 40 per cent. indicates.

Prophylaxis. Caution in handling sick parrots and disinfection of cages and utensils in contact with the bird.

Isolation of patient, destruction of secretions, especially bronchial secretions.

SUMMARY

Treat like a Pneumonia. (See Chap. IV.)

CHAPTER XXXI

RABIES

(HYDROPHOBIA)

This disease, relatively rare in the experience of the individual practitioner, when once encountered, leaves on his mind a more indelible stamp of horror than any other he will meet.

It is conveyed to man in the vast majority of instances through the bite of the dog. It is true that all mammals are susceptible to it and that here and there on the earth's surface other animals than the dog may play a leading rôle in its transmission, as the wolf in Russia. In this country as high as 4 per cent. has been attributed to the cat, while skunks and horses are to be remembered as sources of rabies.

The virus is transmitted by the saliva of the rabid animal and, like tetanus toxin, has an especial affinity for the nervous system, entering the nerve endings at the site of the wound, travelling by the nerve trunks to the spinal cord and by the cord to the medulla and brain, unless the wound be on the face, whence the route to the brain structures is more direct. In respect to its route and in respect to the variability of its incubation period which depends on the length of the route travelled to the central nervous system, it finds in tetanus toxin a close analogue.

The source of the virus is probably but not certainly known. Its incubation period and its multiplication in the animal body demands a living organism as its origin. The so-called Negri bodies, characteristically present in the nerve centers, and now recognized as the pathological criterion of the disease, are probably the infecting organisms. Competent authorities are inclined to place these bodies among the protozoa and, indeed, to fix them more definitely in suborders and families of this kingdom.

In the nervous system they are especially readily found in the cerebral and cerebellar cortex, in the hippocampus major (in the horn of Ammon) and in the corpus striatum (in 98 per cent. or more).

Less than 10 per cent. of men bitten by rabid dogs develop hydrophobia and yet every man developing the disease is doomed to die. What determines on the one hand this relative immunity and on the other the fatal virulency is one of several puzzling problems this disease has offered to the student of infections. The pathological studies of Paltauf have given reason to believe that the immunity of the 90 per cent. is not due to failure of infection, but to the operation of an unknown mechanism of defense in the central nervous system which is efficient before symptoms arise or fails utterly. (For résumé of these studies, see Editorial on Pathology of Rabies in the *Journal of the American Medical Association,* May 14, 1910.)

Incubation. As in tetanus the length of this period depends on the time taken to pass by the nerve from periphery to center; hence, the length of the nerve trunk, or in other words, the site of the wound. For this reason the incubation period after bites on the face or head is much shorter than bites on the extremities. Moreover some other factor operates to delay the incubation in some cases, lengthening out to months and even a year or more.

It may be as short as fourteen days.

The average is set by some authors as forty days, but eight to twelve weeks is common enough.

When a man is bitten by a dog suspected of rabies our procedures are:

1. Immediate treatment of the wound.
2. Confirmation of the suspicion.
3. Preventive, antirabic or Pasteur treatment.

Treatment of the Wound. When there is the least suspicion of the dog the wound should be treated drastically by cauterization.

Lacerated bites are worse than others; bites on exposed surfaces more dangerous than those through clothes; for in these much saliva may be rubbed off the teeth; bites on the face or head are more to be feared than those on the extremity, especially, because of the shortness of the incubation period, and the virulency varies in different animals; wolves are the worst (infection as high as 60 per cent.), and cat's bites are said to be more virulent than those of dogs. No considerations, however, of "more" or "less" dangerous should modify the thoroughness of the local treatment.

The wound should be thoroughly laid open, especially punctured wounds, bleeding encouraged, or when seen immediately after the bite, may be sucked (a procedure not absolutely free from danger, but still a very slight risk).

The wound should be thoroughly washed and liberally bathed with an antiseptic like bichloride 1 to 1,000, then wiped dry and cauterized.

There is a consensus of opinion that **fuming nitric acid** is the best caustic for this purpose. It may be applied on a glass rod or other suitable applicator and should search all parts of the wound thoroughly. When the pain of the procedure, as in children, might lead one to sacrifice thoroughness, it is well to use a general anæsthetic or a local, as cocaine. After the application of the acid the wound may be washed with a physiological salt solution or a saturated solution of bicarbonate of soda and with alcohol. Park says that wounds so treated by the acid, contrary to general opinion, heal well and with little scarring. There is experimental evidence to show that this caustic lessens the incidence of rabies after infection.

Another caustic, inferior, but still of value, when nitric acid can not be had is **phenol** (carbolic acid).

This should be used full strength (95 per cent.) and as thoroughly as the nitric acid.

After the cauterization, the excess should be removed by swabbing with absolute alcohol. Bloodgood and McGlannan (Musser and Kelly, *Practical Treatment*) use first the carbolic, follow it by the fuming nitric acid and then wash the wound with a saturated solution of bicarbonate of soda.

Of other cauterizing agents formalin has been recommended.

Cumming (*Journal American Medical Association,* May 18, 1912) prefers 5 per cent. formaldehyde applied to the wound twelve hours to either phenol or nitric acid. The actual cautery has also been used. Nitrate of silver is useless.

After the cauterization a dry dressing is applied. If the wound suppurates it is to be treated as from any other cause, kept open and dressed.

The sooner the wound is treated the more efficient will be the procedure; this does not mean, however, that the wound should not be so treated, if seen later. In fact, it should be the routine, scabs on older bites should be removed, the wound cleansed and cauterized as above. Rosenau, calling attention to the length of time the virus may remain latent in the wound suggests with reason the excision of the scab and treatment of the wound as an open one.

In fresh wounds on the extremity a tourniquet may be advisable until the wound can be cauterized.

If the wound is sucked, the mouth should be carefully and thoroughly rinsed with antiseptic solutions.

Confirmation of the Diagnosis. If the animal manifest the symptoms of rabies, the head should be sent to the laboratory for pathological examination and the preventive treatment be begun at once, because a failure of pathological diagnosis should not controvert a clinical diagnosis where the price of an error would be so terrible.

When the animal has disappeared and can not be found, an unwarranted attack by the beast should indicate the treatment, while, of course, a provocation of an animal apparently of a normal behavior weighs against the advisability of the measure.

Where any doubt exists, however, the patient should receive treatment.

When the animal is secured and shows no evidences of rabies he should be confined for at least ten days, for the virus of rabies has been shown to exist in the saliva of the animal for as long as eight days before symptoms developed.

If no symptoms develop in this time the danger may be considered past and the Pasteur Treatment unnecessary (Rosenau, *Preventive Medicine and Hygiene*).

Of course, if symptoms of rabies develop at any time during this period of observation treatment should be begun at once.

When the wound is on the extremity in an adult the prolonged period of incubation furnishes enough time to establish immunity by the treatment, but when the wound is in a child and more especially on the face or upper extremity the shortened period of incubation makes every day's loss during this term of observation a source of increasing anxiety, but if symptoms in the dog do appear, it will be too late to establish immunity.

Animals in the early stages of rabies are prone to lick their master's hand or face and while the probability of infection by these means are not comparable to that following a bite, the mere fact that Park (Forchheimer, *Therapeusis of Internal Diseases*) can cite at least eight fatal cases to his knowledge following this mode of infection makes his advice to take the treatment almost an imperative command.

Shooting of a dog before symptoms are obvious defeats the diagnosis, pathological as well as clinical.

Symptoms of Rabies in the Dog. The earliest evidences of the disease are perhaps manifested in a change of disposition of the dog; he is unlike himself, secretive, hiding himself, irritable, uneasy and restless, abstracted, destructive of objects, apt to run away from home and later bites without provocation, a striking symptom in a gentle dog. A change in the timbre of the voice is very significant. In two to four days the furious delirium in which the dog attacks man and animals and objects, followed by paralysis, occurs, or the paralytic stage ensues without that of furious delirium (dumb rabies).

Unlike the human being the rabid dog has no fear of water. The dog dies in a week or less from the first appearance of symptoms.

Two popular beliefs are to be combated; first, that a rabid animal always froths at the mouth, and second, that rabies is confined to the hot "dog days" of summer.

Preventive Treatment. Had Pasteur contributed nothing more to human welfare, his work on rabies alone would have raised for him a sign to all time ten-thousand fold better than a "monument of imperishable brass."

The essence of his discovery was that the virus of rabies, localizing in the nervous system could under certain conditions and environments be so modified in its virulency as to be used in other animals to provoke the mechanism of defence to the active production of immune bodies; in other words to establish immunity; and that, too, with an expedition that forestalled the multiplication of the virus already introduced to a degree dangerous to the patient.

Improvements in technique have been engrafted on his treatment, but it fundamentally remains the same to-day as when he devised it.

Pasteur first used the virus attached to the nerve tissue of rabid dogs brought in from the street and to this kind of virus has been given the designation of "street" virus. He soon found that the virulency of this "street" virus was variable and that rabbits injected with it showed an incubation period of fourteen to twenty-one days. In his effort to overcome this variability he found that running it through rabbits, that is, dog to rabbit and then rabbit to rabbit it became progressively more virulent as measured by the shortening incubation period up to a fixed period beyond which he could not go, of six days.

This virus he called "fixed" virus and found constant in its potency and in its effects for his purpose.

One other mysterious change was wrought in this virus in the process of fixing. It was found to lose virulency in the dog becoming even avirulent in man while it was increasing in virulency in the rabbit. Adequate explanations for these facts are not yet forthcoming and, yet, on it depends its efficacy in treatment.

His next step was to obtain this virus in varying but definite degrees of virulency. This was accomplished by taking the spinal cord (as more easily manipulated than the brain) of a rabbit dead of the effects of the "fixed" virus and drying it over potassium hydroxide in a bottle at 70° F. kept in the dark. Day by day as the cord desiccates it loses its virulency until the fourteenth day when it is no longer capable of inducing infection. For a brief résumé of the technique of preparation of the virus used by the New York Board of Health, see Park in Forchheimer's *Therapeusis of Internal Diseases.*

Portions of the cords dried longest are ground into an emulsion in physiological salt solution and injected under the skin of the abdominal wall. Each day this injection is repeated, using portions of cords dried a lesser period, i.e., of increasing virulency (for the rabbit) until the stronger cords are used.

Slight modifications of the original Pasteur scheme of inoculations are adopted by different institutes and laboratories.

The suitable scheme for the virus used is furnished the practitioner by the institution supplying the virus, when it is necessary for him to administer treatment.

The duration of the treatment is from fifteen to twenty-six days, which fortunately is short of the usual incubation period, in most cases, although full immunity does not obtain until four or five weeks are past. Bites about the head and especially in children may, however, be followed by so short an incubation period or the patient's treatment may be begun so late after the bite that immunization cannot be achieved by the original Pasteur scheme. Shorter incubation periods, too, follow the bites of wolves and cats. It becomes a great desideratum, then, to hasten the process of immunization.

It is the custom, therefore, in case of bites about the head to treat the patient morning and evening for the first two days, or to make the treatment more intensive by using the stronger cords earlier.

More recent work, however, has given promise of a quicker method of immunization by the use, from the first of unchanged, fresh virus. Proescher of Pittsburg has been a pioneer in this work in this country. (For details, see *Archives of Internal Medicine,* September 15, 1911.) He uses the "fixed" virus in the brains of rabbits. Three c.c. of an emulsion in physiological salt solution containing 0.01 gram of **"virus fixe"** is injected subcutaneously in the abdominal wall and 0.05 grams used in the course of the whole treatment of one injection each day for five days.

If immunity is really established in this time as from his results Proescher believes it to be, certainly a great stride has been made towards the perfection of the procedure of immunization.

When a State or Municipal Laboratory or Institute is at hand, patients should be treated there preferably; but as these are accessible to the relatively few the

Treatment at a distance from the laboratory becomes of great importance.

This is effected by sending pieces of desiccated cord with instructions for the emulsification or the emulsion is sent in a preservative of carbolic or glycerin or is supplied by manufacturers in syringes ready for use, as diphtheria antitoxin has long been put up.

The U. S. Public Health and Marine Hospital Service have been accustomed to furnish virus to State Boards of Health to be used under their direction and have found the results perfectly satisfactory.

The treatment requires no special confinement, but the patient should avoid fatigue or excesses of any kind. Very little or any disturbance occurs of any kind as a result of the treatment in the vast majority other than those that may naturally be attributed to the concern of the patient as to the outcome of his infection, mild rashes or slight anaphylactic manifestations.

In rare instances more serious results ensue in an affection of the nervous system, causing neuralgia, paræsthesia and even paralysis, paraplegias, ascending paralysis and death. The fatal issue is extremely rare. Whether this is due to the virus itself or is an anaphylactic phenomenon is not settled.

They occur late in or following upon the treatment. They last a few days to several weeks. Treatment is symptomatic.

There are no contraindications to the treatment.

It is remarkable, as has been commented, that in the 100,000 cases in which this living virus from the rabbit has been used, it has induced rabies in no instance.

Just how long the immunity so established lasts is not determined but probably for some years; however, a patient bitten again by a mad dog should certainly repeat the process of immunization unless the second bite follows close upon the first.

Results of Preventive Treatment. It is hard to confine oneself to the bare statement of facts, when so much that is dramatic invites to an ebulition of enthusiasm. Granted that 10 per cent. of the bites from rabid dogs resulted in rabies. All these cases meant death, without exception.

What the preventive treatment has done is best shown by statistics; 30,000 cases treated by the Pasteur Institute in Paris gave a mortality of 0.5 per cent. to 1 per cent.

Park's statistics of 2,405-cases treated by the New York Board of Health virus showed a mortality of 4 per cent. among those bitten on the head and 3 per cent. among those bitten elsewhere; but his statistics further show that if time for the full development of immunity passes, that is two weeks beyond the full course of treatment, the mortality sinks to 0.3 per cent. in the first and 0.2 per cent. in the latter class of cases.

Symptoms of Hydrophobia. They have been divided into three stages:

1. Premonitory stage, characterized by malaise, irritability, depression, anxiety, change in disposition, difficulty in taking water, hoarseness, some nervous twitchings or rigors, lasts a day or two, at times longer.
2. Stage of excitement. Great thirst and spasms of muscles of deglutition, the real hydrophobia, intense hyperæsthesia that dreads even the breath of bystanders on the skin, convulsions and delusions.
3. Paralytic stage. Paralysis, coma and death.

The paralytic stage may come early and dominate the picture.

Treatment of the Developed Disease. I know of no more distressing duty that falls to the lot of a practitioner of medicine than this nor any that has left the indelible impression on my own mind that this sad experience has impressed.

To my mind it has only one object, to lessen the patient's sufferings and smooth the way to the end.

Another peculiarity that marks the disease as different from others is that there is no partial immunity established; it is all or none. Its onset spells death and the dubious rare report of a recovery (undoubtedly most often a lyssophobia or nervous symptom complex precipitated by fear) gives no warrant to exhaust those measures designed to prolong life to the provocation of renewed agonies and to add hours of suffering without result.

The room should be darkened and quiet, and all noise, talking, unnecessary handling rigorously excluded.

I have heard the patient plead to avoid the draught from an open door, stuff the chinks about the window, stand further away and turn the head while speaking to avoid the air.

Only those who can be of help should be present. What little food can be taken should be concentrated and suggest fluid as little as possible, such as ice cream, custard, or junket. The bed should be of the hospital type to facilitate handling.

Enemata seem to be the only humane way to relieve the intense thirst.

In the early stages of nervous irritability and hyperæsthesia large doses of chloral and bromides by the rectum may cause some sedative effect. The doses should be liberal gr. xxx (2 Gm) of chloral and ʒi (4 Gm) of bromide or even larger doses of both in the adult.

When the convulsive paroxysms come on, only chloroform by inhalation is of use, while morphine hypodermatically may lessen their frequency and the patient's suffering and horror in some measure. The amounts of these drugs that shall be given can not be accurately stated; they must be given in large doses, large enough to accomplish the end desired. Without these two agents to apply, the sufferings of those who are there to minister would be second only to those of the patient.

Attendants, while in no great danger, still should remember that the patient may be a source of infection through his saliva and should take precaution to protect themselves by the wearing of gloves, cauterization of superficial wounds contaminated and restraint of patient during his maniacal periods. One can conceive the necessity of immunization of an attendant accidentally wounded by a patient in delirium.

It would seem logical to use the serum of an immunized animal during the attack, but its use has proven in every instance useless.

Prophylaxis. That such a disease, when preventable, should exist at all within the borders of a State would seem to be a distinct crime against its members. That it does exist in civilized communities is largely due to the difficulty of grasping the just relationship between communal and individual rights.

As the disease is nearly always conveyed to man by the dog, stamping the disease out among dogs practically excludes it in a community. The means to accomplish it are so simple, the inconvenience so slight compared with the results, that it seems amazing that enough opposition should be found to defeat legislative efforts to that end, and yet such is the fact.

Among the measures advised to accomplish this end are

Quarantine. In Australia, where rabies is unknown, the fact is attributed to a law making a quarantine for six months for all dogs brought into the country imperative.

Muzzling. Great Britain has succeeded in eliminating rabies from its confines by an efficient muzzling law.

This can be affected by muzzling all dogs at large for at least six months after the last case of rabies in the community or its immediate environments.

Less drastic and less useful is the use of the **leash.**

Detention. Valuable but less thorough, is the detention, under observation for three to six months of dogs thought to have been in contact with rabid dogs.

Licensing. A law to license all dogs with destruction of the unlicensed, lessening the number of dogs by high tax and primitive measures, such as holding the owner responsible for damages done by the rabid animal. These latter measures but provoke resentment.

What is needed is a campaign of education in the problem to lay the path to legislation for quarantine or muzzling with compulsory reporting of cases and killing of all animals bitten by rabid dogs.

Rabies in This Country. That the laws against rabies is inefficient is shown by the increase in numbers and distribution of cases. Of course, the States as independent legislative units, have met the problem differently and more or less satisfactorily.

In 1908 Kerr and Stimson, under the U. S. Public Health and Marine Hospital Service, collected 1,500 cases who applied for Pasteur treatment that year from thirty States, and 534 infected localities.

There were 111 deaths.

All were from the Eastern three-fourths of the country, none in the Rocky Mountains and Pacific Slope.

Three years later, 1911, Albert reported 4,625 persons receiving treatment from 1381 infected localities.

Moreover his report showed the invasion of the Western quarter of the country, where in some localities it was believed the spread was due to skunks.

Finally the incidence of cases by States was determined by the more or less efficient measures adopted for the regulation or stamping out of the disease.

SUMMARY

When a man is bitten by an animal suspected of rabies.

1. Treat the wound.

2. Confirm the suspicion.
3. Institute antirabic or Pasteur treatment.

Treatment of the wound.

Lay wound open thoroughly.

Encourage bleeding.

Wash thoroughly.

Bathe in antiseptic, e.g., 1–1,000 bichloride.

Wipe dry.

Cauterize.

Best caustic is fuming nitric acid; apply on a glass rod or other suitable applicator, searching every part of the wound.

If pain prevents thoroughness, give an anæsthetic, general or local.

Then wash the wound with physiological salt solution, ʒi–Oi (4 Gm–500 c.c.), or with a saturated solution of bicarbonate of soda and with alcohol.

Phenol, 95 per cent., may be used as caustic in same manner as nitric acid, but is not so good.

Remove the excess of carbolic acid by swabbing with absolute alcohol.

Method of Bloodgood and McGlannan.

> Use first phenol, 95 per cent., then fuming nitric acid, then wash wound with saturated solution of bicarbonate of soda.
>
> Five per cent. formaldehyde applied twelve hours (Cumming).

Actual cautery.

Apply dry dressing.

Do not use silver nitrate for cauterizing.

Suppurating wounds dressed like those from other causes.

Keep open and drain.

Old bites.

Remove scabs.

Clean wound.

Cauterize as above.

Excise area of scab.

Treat as open wound.

In wound of extremity, if fresh, a tourniquet may be applied until the wound can be cauterized.

Confirm suspicion. (See text.)

Prevention. Antirabic or Pasteur Treatment. (See text.)

Treatment of developed case.

Fatal issue is certain; hence, treatment is palliative to lessen suffering and smooth the way to the end.

Room.

Must be quiet, avoiding even talking and all unnecessary handling.

Avoid all draughts of air; may be necessary to stuff chinks in windows.

Diet.

Concentrated and suggest fluid as little as possible, e.g., ice-cream, custard, junket.

- Thirst is intense.
  - Can only be relieved by enemata or Murphy drip method.
- Early stages.
  - To lessen nerve irritability.
  - Chloral and bromides, large doses.
  - Chloral, gr. xxx to gr. lx (2–4 Gm) by rectum (adult).
- Bromides.
  - Combine with chloral in double the dose of the chloral. Give by rectum in warm milk ℥ii–iii (60–90 c.c.).

Convulsions.

- Chloroform inhalations.
- Morphine hypodermically.
- Amounts must be sufficient to accomplish desired results.

Maniacal periods.

- Restraint.
  - Attendants must remember that patient's saliva is infectious.
    - Should wear glasses.
    - Should cauterize superficial wounds contaminated.
    - Should undergo preventive treatment if wounded by patient.

Prophylaxis.

- Enlightened laws and Health Board regulations.
- Quarantine.
  - Six months for all dogs brought into country (Australia).
- Muzzling.
  - All dogs at large for six months after a case of rabies (Great Britain).
- Less drastic and less effectual.
  - Use of leash.
  - Detention for three to six months of dogs in contact with rabid dogs.
  - Destruction of unlicensed dogs.
- Public education.

CHAPTER XXXII

TETANUS

Tetanus is a disease due to the action of an organism first described by Nicolaier in 1884 and named Bacillus tetani. The symptoms of the disease are effected by the operation of a toxin elaborated by the organism, carried to a distance from the site of infection, entering into and acting upon nerve tissue for which it has a striking affinity.

In this the Bacillus tetani is like the Bacillus diphtheriae.

The toxin affects the motor end plates of the nerves, travels by way of the axis cylinders to the spinal cord and motor nuclei at the base of the brain and arriving here, and only when arriving here, induces by its irritating effects on these centers the characteristic symptoms of the disease.

If the infecting wound brings the toxin at once into intimate contact with motor end plates as a wound of a muscle of the leg, the absorption of the nerve supplying that muscle will be facilitated and evidences of the disease will be manifested in this extremity first, hence, is called "local tetanus" and as the other nerves more remote from the site of the wound are affected the symptoms seem to advance up the body, hence, it is called tetanus ascendens, but if the wound is in the subcutaneous tissue, as it usually is in man, as Ashurst and John explain, the toxins, diffused by way of the lymph channels, act on all motor end plates practically simultaneously and those centers sending out the shorter nerves would actually be reached earliest; hence symptoms would appear in the territory of the short facial nerves with early trismus and in the longer nerves later, hence, Tetanus descendens.

The toxin in all probability also spreads along the cord when carried there by way of the nerve trunks or by way of the general circulation.

The sensory as well as the motor side of the cord is affected and the irritability of the reflexes heightened.

Incubation. After the infection some little time must elapse between the invasion of the tissue by the bacillus and the arrival of the toxins at the centers. This will depend on the activity of the germ in the wound and the facility of transportation for the toxins; for example, the length of the nerve trunk travelled.

The average time is seven to nine days. Under nine days cases are called acute, over nine days chronic. Spores may lie for some time in the tissues before they mature and thus the incubation period be lengthened to weeks or even months.

The **symptoms** of this disease, then, are attributable to the heightened and uncontrolled operation of the motor centers under the whip of the toxins, and show first and most marked in the territory of those nerve centers first and most affected; hence, after possible prodromes of headache and pains in the back we get commonly trismus (lockjaw); later, contractions of the muscles of the neck, trunk and extremities.

These contractions are tonic and continuous, interrupted by clonic convulsions, often severe and painful, which are induced by slight irritations.

Moderate fever obtains, sometimes becoming hyperpyrexia, especially, near the end.

Treatment of the Developed Disease. It is to be regretted that the use of "specifics" has too often invited the thoughtless to an undue reliance on them and to a failure of consideration for equally important measures.

Certain measures aiming at the conservation of the patient's energies in his struggle to subdue the infection such as bodily and mental rest, the meeting of energy demands through food intake, and careful nursing are such important measures.

Room. A well ventilated room as remote as possible from the noises of the street or the rest of the household should be chosen; this should be somewhat darkened. The exquisite sensitiveness of the sensory-motor apparatus has to be kept in mind and the ease with which slight stimulation of the same precipitates the distressing clonic spasms; so, sudden noises, such as loud talking or exclamations, jarring of doors, windows, or heavy tread, moving of furniture, are to be carefully avoided. Cotton may be put in the ears.

The bed is best of the hospital type, that is one about which the nurse can perform her duties to the patient with the least disturbance to him.

A water bed may prove a source of comfort. Skilful nursing is required to subserve the needs of the body without exciting spasms. Baths should be given by sponges and the water be lukewarm as least likely to provoke a shock and a resultant convulsion.

Diet. Feeding is a difficult task on account of the locking of the jaws and the spasms of muscles the effort excites.

It is obvious that all food must be liquid and as concentrated as possible, as the repetition of the act of feeding is distressing and the danger of aspiration and ensuing pneumonia is always present.

Milk, cereal-waters, eggs raw, all fortified with sugar to increase the caloric value are suitable.

So difficult is oral feeding, that rectal feeding and nasal feeding are sooner or later necessary as adjuvants to or substitutes for oral feeding, and even efforts at subcutaneous feeding have been made. As a nutrient enema Bloodgood advises 200 c.c. of peptonized milk, two eggs and enough salt solution, physiological (roughly, ʒi to Oi) to make up to 500 c.c. and administer by the drop method of Murphy.

One may give the milk without peptonization and fortify with sugar, adding salt ʒi to the pint (4 Gm to 500 c.c.) and brandy or whisky. For example 500 c.c. milk, sugar 45 grams and whisky or brandy 30 c.c. would furnish 600–650 calories. If slowly introduced the bowel may be made to retain this amount and in this the spasm of the sphincter may assist. Nasal feeding is done by passing a small flexible rubber tube through the nostrils into the stomach.

To lessen or overcome the spasm that blocks the passage of the tube morphine in doses of gr. ⅛ to gr. ¼ (0.008–0.015 Gm) hypodermically may be given beforehand or chloroform may be used during the procedure.

While little reliance can be put on subcutaneous feeding, olive oil has been used and solutions of grape sugar, 5 per cent. to 10 per cent.

Park mentions the use of normal horse serum saying that 500–1,000 c.c. can be given. The tissues are in much need of water, which can be supplied best perhaps as a saline solution by the drop method. A pint (500 c.c.) may be given four times a day. Fluid can also be given subcutaneously, but with the extreme irritability of the nerve structures it is not a good method in this disease.

Bowels. When seen early a saline can and should be given; later one has recourse to enemata.

Urine. Watchfulness to detect the retention of urine that may occur is necessary and its retention entails the use of the catheter.

The second consideration is the elimination of the focus of infection so far as possible. This is accomplished by rigorous **local treatment.** The wound should be treated on surgical principles, laid wide open, sloughing material removed, packed and allowed to heal by granulation. Ashurst and John advise swabbing the wound with 3 per cent. alcoholic solution of iodine, followed by hydrogen peroxide and packing with gauze saturated with the iodine solution. They say that if amputation becomes necessary the wound of the stump should be left open and treated in the same way. It has been advised to excise the glands related to the lymphatic system draining the affected area if they seem in any way involved. Cauterization is decried as favoring the growth of the anaërobic tetanus bacilli.

Specific Treatment. The third measure relates to a neutralization of the toxins of the disease by antitoxin. Unfortunately the combination of toxin with tissue has been so completely effected before treatment is begun—for the symptoms of the disease do not appear until this combination takes place—and furthermore the combination is so stable that results comparable to the use of the analogous antitoxin in diphtheria are not obtained. It is the fact, however, that some toxin is still circulating free in the tissues to add its further poisonous action to the cells that makes the use of the antitoxin imperative, for there is evidence that time is required after the toxin has reached the nerve tissue for the union to become stable, and during this period antitoxin if given in sufficient quantity may attract the toxin out of the nerve substance into a union with itself.

The Antitoxin. The antitoxin is elaborated in exactly the same way as diphtheria antitoxin in the horse, whose serum becomes the vehicle of its administration.

The unit adopted in this country is about ten times the size of the diphtheria antitoxin unit. See Diphtheria, Chap. X.

Use of Antitoxin. Our efforts are aimed at getting the antitoxin in contact with the toxins both while circulating free and when in loose combination with nerve tissue.

These efforts are effected by giving the antitoxin into the subcutaneous tissue and into the vein to secure the first result and into the cord, into the nerve trunk, into the brain and into the muscle about the end plates to secure the second result.

Of these routes the intravenous, the intra-spinal and intraneural are the important.

Subcutaneously. So readily is this procedure carried out in comparison with the others that I feel it incumbent on me to emphasize the teaching of the able workers in this field relative to the efficiency of the specific when so administered. Park in his article in Forchheimer's *Therapeusis in Internal Diseases* says: "A subcutaneous injection is not wholly absorbed for three days. The water holding the antitoxin in solution is quickly absorbed, but the antitoxin is held back. At the end of six hours only about 10 per cent., twenty-four hours 35 per cent., forty-eight hours 65 per cent., and at seventy-two hours and ninety-six hours 100 per cent."

In a study on man injected intravenously with 10,000 units Park found the highest antitoxin content of the blood at the end of forty-eight and seventy-two hours amounting to 1 unit per c.c.

He goes on to say that when given into a muscle the absorption is three times as fast, being accomplished in twenty-four hours but even here the absorption is uncertain and not comparable with the intravenous method.

Dosage. It can readily be seen that because of the slowness of absorption and its great dilution in the blood, lymph and tissue juices, little can be expected of it unless administered in massive doses. These doses are limited only by the expense entailed in their purchase. Over 100,000 units in six hours have been advised, 15,000 and more every three hours and in one case actually 224,000 units were given in three days, happily with recovery.

It can only be said that this route should never be preferred to the vein if it is possible to get into the latter; if not, the muscle should be preferred to the subcutaneous tissue.

Intra-muscular. As has been said, this route is better than the subcutaneous, but, never should be chosen over the vein. Its use in the muscle about the site of the wound to attack the toxin at the end plates has another purpose.

Intravenous Injections. This method assures rapid contact of antitoxin with such toxins as are still circulating free in the fluids of the body, while the antitoxin content of the blood is more than twice that obtainable by subcutaneous injection.

Dosage. Even by this method the dose should be large and it must be remembered that the efficacy of a given dose is multiplied many fold by being administered early. At the first suspicion of the condition the serum should be administered.

The dose recommended is 10,000 to 15,000 units once or twice in twenty-four hours, and this large dose because, as Park says, though it is many times more than enough to neutralize the toxins present in the blood, the antitoxin experiences difficulties in passing from the blood to the cellular fluids, "the tissue fluids only contain about 3 per cent. of the antitoxic content of the blood." (Park.)

It has been advised to give one large intravenous dose to start with and smaller subcutaneous doses every day or two until symptoms cease or to give lesser doses by the vein every day. I should feel that in so dire a condition it were wise to lean towards the larger doses and shorter intervals, when the expense does not forbid.

Small children may be given one-half the dose and infants one quarter. Park recommends as "a good working rule," 2,000 units for every ten pounds. Perhaps if only one method of administration could be used the intravenous would prove the best, and in practice it should be given preference as a means of getting antitoxin into the body fluids, while as important adjuvants to its operation methods of bringing the antitoxin into direct contact with nerve tissue should be sought.

These methods are the intra-spinal, the intra-neural, the intra-cerebral and the intra-muscular at the seat of the wound.

Intra-spinal. This is called the best method by Park and with this I heartily concur. It is conceived that the serum so given will come into more immediate contact with spinal centers and that the more likely if the cord or cauda is wounded by the needle. It has been thought, too, to diffuse readily into the blood stream from the cerebro-spinal fluids.

The **dose** should be 3,000 to 5,000 to 10,000 units (6 to 20 c.c.)

each day until improvement sets in. For table of amounts to be injected, consult table of Sophian. (See Cerebro-spinal Meningitis.)

The technique is that of the administration of cerebro-spinal meningitis serum. (See Cerebro-spinal Meningitis, Chap. XVII.) One should combine the intravenous and intra-muscular method with it.

Intra-neural. Of late an especial plea has been made for intraneural injections. It is claimed on the basis of experimentation that antitoxin injected into the nerve travels like toxin by way of the nerve to its centers to operate on the toxins there. The large trunks leading from the wounded area are selected and injected at a site as near the cord as is feasible to expose them. The sciatic, the anterior crural, the obturator and cauda equina have been injected in the lower half of the body, while the strands of the cervical plexus, the hypoglossal and spinal accessory are legitimate points of attack in the upper half.

Ashurst and Jones have put as much as 1,500 units into the sciatic nerve and 750 into the anterior crural.

If injected slowly much is absorbed into the nerve trunk.

The disadvantage is the nicety of surgical procedure demanded. It must be remembered that this is only an adjuvant method and that the other nerves have to be reached by other methods.

Intra-cerebral. This method was early tried, but the results seem to be so little encouraging and the dangers and sequelæ of the procedure so considerable that I am inclined to advise against.

Intra-muscular. Injections of antitoxin may be made about the wound, into the muscles to bring the serum in contact with the motor end plates to be first affected.

Park advises a dose of 3,000 units intraspinally and 1,000 to 2,000 units into the vein as soon as possible.

The next day 3,000 more intraspinally.

On the fourth or fifth day 1,000 units intravenously.

This method is designed to keep the blood strongly antitoxic. So efficacious does the intraspinal method seem to be that the accessory injections into vein and especially into subcutaneous tissue are less urgent. **This I believe to be the best method yet devised.**

Drug Treatment of the Disease. All such treatment is empirical, having the weakest kind of basis.

Such, for example, is the use of Phenol (Carbolic Acid).

This method was introduced by the Italian, Bacelli, and its usage has followed his recommendations with slight modifications as to dosage and concentration. He gave 0.30–0.50 grams (gr. v–viiss) a day.

It may be given in ½, 1, 2 or 3 per cent. watery solution and has been used in oil 5 per cent.

It is given hypodermically and at frequent intervals hourly or every two hours. An injection of m. xx of a 2 per cent. solution at two hour intervals would give about 5 grains a day; to increase the dose one may make the intervals shorter or the solution stronger, as 3 per cent., which in same amounts and intervals give about 7 grains.

One should remember that if antitoxin is given at the same time it contains as a preservative 5 per cent. trikresol probably operative in the same direction.

Evidences of poisoning by inspection of the urine (smoky urine) should be sought for, but the body seems to be peculiarly tolerant in tetanus.

The statistics seem too good to be true and especially in the absence of experimental corroboration.

When, however, antitoxin is not at hand or in insufficient quantity phenol should be used.

DRUGS IN THE TREATMENT OF THE SYMPTOMS

The most urgent symptom is the **convulsion**, because of the great exhaustion it entails and because of the fatal spasms that may occur. There are two classes of drugs used for this purpose, one to lessen the irritability of the centres, lessen the severity of the tonic contractions and frequency of the clonic, a milder group; and the other more imperative, quelling the convulsion. Among the first belong bromides and chloral, the most important and mentioned together because they should be used together to get the best effects.

Large doses should be used; for the pharmacological depressing effect on the spinal centres is sought and the condition for which they are used a thousand times more menacing than their toxic effects on circulation or respiration.

Chloral should be given in doses of gr. xv (1 Gm) every three hours or gr. xxx (2 Gm) every six hours increased to gr. xlv (3 Gm) and gr. lx (4 Gm) every six hours, if the spasm is severe, and heart and respiration are watched. **Bromides** may be given at double the chloral dose, as potassium bromide or mixed potassium, sodium and ammonium bromide, at the same time or in the intervals.

These are adult doses and should be correspondingly decreased for children. They may be given by mouth through nasal or stomach tube if necessary or by rectum, milk furnishing in the latter method a good menstruum.

Among other drugs belonging to this group but less reliable are atropine, hyoscine, physostigma and chloretone.

Standing between groups one and two is a very valuable drug.

Morphine. This drug not only lessens the spasm, but it relieves pain, induces sleep, and given before any disturbing procedure such as dressing the wound, giving enemas or rectal feeding, passing nasal tube or catheter makes the procedure less trying and less provocative of spasm. The doses should be large, gr. ¼ to gr. ⅓ (0.015–

0.02 Gm), up to gr. iss or gr. ii (0.1 or 0.125 Gm) a day. Atropine is well combined with it.

The severity of the clonic spasms and the suffering they sometimes entail demand more dominant measures such as are furnished by the second group of drugs; namely

Chloroform. This is given by inhalation during the exacerbations of the spasms. It has been used continuously over periods of hours and days, but it is the conviction of some observers that such usage constitutes a danger in itself.

Magnesium Sulphate. Intra-spinal. A method suggested by Meltzer of utilizing the depressant effects of magnesium sulphate when brought into direct contact with the cord was eagerly seized upon, but was found to possess dangers of its own; however, the severity of the spasms, pain and exhaustion may be such as to make the measure in spite of its attendant dangers advisable, but it certainly is not to be undertaken lightly.

A 25 per cent. watery solution of magnesium sulphate is used. The dose 1 c.c. to every 25 pounds of the patient's weight, discounting somewhat for the very obese and large of frame.

The spinal puncture is made as for an exploration (see Cerebrospinal Meningitis, Chap. XVII), except that the shoulders should be somewhat raised to prevent rapid diffusion of the solution upwards towards vital centres.

The needle should withdraw an amount of cerebro-spinal fluid equal to that amount of solution to be used, the syringe then attached to the needle and the salt introduced slowly.

The spasms disappear and do not recur for hours or sometimes days. A recurrence of severe type would indicate a repetition of the procedure. The danger lies in respiratory collapse.

The patient should be under competent observation during the few hours after the injection and artificial respiration and stimulation undertaken if necessary.

DRUGS OF MORE DOUBTFUL VALUE

Chloretone. This drug in whiskey by mouth or olive oil by rectum has been used in doses of gr. xxx (2 Gm) every two hours until the patient sleeps. Even doses as high as 66 and 75 grains (5 Gm) have been advised.

Atropine. This drug is used in combination with morphine or alone to lessen the spasm and as Bloodgood says finds its principal value in the prevention and relief of the distress due to an oversecretion of mucus in the air passages. The dose should be gr. 1/100 to gr. 1/25 (0.0006–0.0025 Gm) into the contracted muscles.

It can be repeated at four hour intervals up to the well known physiological limit—dilated pupils—excessive dryness of mucous membranes or rash.

Hyoscine. This drug, like atropine derived from the solanaceæ acts like atropine to lessen spasm but is more depressing to the cortical centres and in so far is a desideratum, but it is also depressing to the respiratory and cardiac centres and so has to be watched with care. It may be given in doses of gr. 1/100 (0.0006 Gm) twice a day.

Physostigma or calabar bean, best in the shape of its active principle, eserine sulphate, has also been administered hypodermically in doses of gr. 1/6 (0.01 Gm) every three or four hours. Diarrhea or muscular twitching, if it can be made out during the tonic contractions, indicates the physiological limit and interruption of its administration.

Circulatory stimulants may be indicated in the exhaustion following chronic spasms.

Causes of Death. 1. Spasm of the larynx with ensuing asphyxia.

2. Spasm of the respiratory muscles, intercostals and diaphragm with asphyxia.
3. Cardiac failure.
4. Starvation.
5. Hyperpyrexia.

If the patient survives there may be some muscular stiffness for a long time after the subsidence of the attack.

Prognosis. The longer the incubation period the better is the prognosis and the longer the symptoms have continued the better is the eventual outlook; that is, fatal cases are likely to be shortly fatal, or in other words the prognosis depends on the severity of the infection and the resistance of the patient. Extensively distributed spasm is of bad omen and hyperpyrexia very fatal.

Prognosis depends largely on the promptness and efficiency of the treatment and especially the use of antitoxin. While here and there a man of experience expresses himself in this way: "The mortality has not been reduced by treatment save as to prevention" (Hill in *Archives of Internal Medicine,* December 15, 1911), others, and the majority, take a more cheerful view of the value of therapeusis. Park says, "If every case were given an intravenous injection of antitoxin at the time of diagnosis, and treated well in other respects, probably 50 per cent. would recover" (Forchheimer's *Therapeusis of Internal Diseases,* Vol. 2), while lists of statistics may be found attributing a fall in mortality from 80 per cent. to 90 per cent. down to 45 to 30 and less per cent. under antitoxin. A series of over 200 treated cases studied by Irons shows a mortality of about 61 per cent., a drop of 20 per cent. from the average mortality. Far better results are following the intra-spinal method.

Prophylaxis. Whatever disagreement there may be about the efficacy of treatment by antitoxin there is no dispute about its value as a prevention, though some surgeons believe that tetanus is a rare complication in a wound promptly and properly treated.

Prophylactic treatment, then, resolves itself into two lines of endeavor.

1. Treatment of the wound.
2. Antitoxin administration.

Treatment of the Wound. The first essential is a knowledge of what kind of wounds under what kind of environment are likely to result in tetanus.

While it is possible that an infection under certain conditions may originate in the intestinal canal, for their presence in the intestine is not a rare finding and in hostlers a common one, or that the bacilli may be resident in the catgut used in surgical procedures, still the vast majority come from punctured and lacerated wounds contaminated by dirt from barns, stables, bites or other wounds from horses, punctured wounds from nails, fish bones in garden soil or barnyard refuse; lacerations, by farm-yard implements, machinery, gun-shot wounds, toy-pistols and giant crackers.

The Fourth of July harvest has each year taken the heaviest toll of any cause.

After cleansing the surrounding points and the wound with green soap, alcohol and ether or painting with tr. of iodine, every suspected wound then should be laid wide open to the very bottom by a free incision, bits of dirt, cloth, wood or powder removed, lacerated shreds separated with scissors or the wound area excised and the wound treated with

Antiseptics. For this purpose a 3 per cent. alcoholic solution of iodine may be used or pure phenol, followed by alcohol. The wound is then loosely packed with the iodine solution and dressed daily after irrigation with peroxide of hydrogen with the gauze soaked in iodine solution or with iodoform gauze. No caustic should be used as the germs are anaërobic and will thrive best under the eschar produced by such agents. The wounds should be kept open and allowed to granulate from the bottom.

It has been advised to use powdered dry antitoxin in the wound or the liquid antitoxin itself, applying a loose dressing over it. In other words the wound is to be treated by sound surgical methods.

Use of Antitoxin. This should be given at once. Its efficacy is best demonstrated by the fact that the high death rate from tetanus after Fourth of July wounds has been almost if not quite wiped out in those hospitals where it has been used at the time the wound was dressed.

Dose. The usual dose is 1,500 units given subcutaneously. It is well to give the antitoxin near the site of the wound, into the muscle, to protect the motor end plates at the site of toxin formation first and the remoter nerves next.

Repetition of the Dose. It has been shown that in eight or ten days all the antitoxin has been eliminated and for this reason a second dose of the same amount should be given. This second dose will almost surely protect. Some cautious men, however, give a third dose and some continued doses at these intervals until the wound is healing in a healthy manner by granulation.

Some men have relied on the local use of antitoxin in the wound as described; but, if antitoxin seems indicated at all it should be given under the skin, whether it be used locally or not.

The dosage in a child may be a little less, 1,000 units, but there is no objection and some value in the larger dose.

Serum Disease. Rashes and joint pains as after diphtheria antitoxin may appear, but are of little importance.

SUMMARY

Incubation time.

Average seven to nine days. May be weeks or months. (See text.)

Symptoms.

Due to irritation of motor nerves inducing tonic contraction of muscles interrupted by clonic contractions, which are easily excited by slight stimuli.

Treatment.

Rest.
Elimination of every stimulus to the highly irritable motor centres.

Room.

As far away from the noise of the street and the rest of the household as possible.
Avoid sudden noises, such as jarring of doors and windows, heavy tread of feet, moving furniture, loud talking.
Cotton may be put in the ears.
Room should be a little darkened.
Should be well ventilated.

Bed.

Half-bed of the hospital type, with woven wire springs, firm mattress, smooth sheets.
Water bed may be more comfortable.

Care of the body.

Baths should be given of sponges of warm water in a warm room, as least likely to provoke a convulsion.
Mouth—best rinsed with clear warm water or saline solution, or 2 per cent. boric acid from time to time unless it incites the clonic contractions.

Diet.

Feeding very difficult.

- Liquid foods; concentrated, administered as infrequently as compatible with body needs.
- Milk, cereal waters, eggs; all fortified with sugar.
- Sooner or later rectal or nasal feeding must be used in part or wholly.

Rectal feeding.
- Two hundred c.c. peptonized milk.
- Two eggs.
- Salt solution (ʒi to Oi) (4 Gm–500 c.c.) up to 500 c.c. or 1 pint and administer by the drop method of Murphy (Bloodgood).
- or 500 c.c. raw milk.
- Forty-five grams milk sugar. } 600–650 cals.
- Thirty c.c. whiskey or brandy.
- Introduce slowly into bowel.
- Two or three rectal feedings a day is about all the bowel will take for any length of time.

Nasal feeding.
- Use small flexible tube.
- If spasm blocks the tube give
- Morphine, gr. ⅛–gr. ¼ (0.008–0.015 Gm). (Adult dose.)

Subcutaneous feeding.
- Doubtful value.
  - Olive oil.
  - Grape sugar, 5 per cent. to 10 per cent. (real value).
  - Normal horse serum, 500–1,000 c.c. (Park).

Fluids.

- On account of the difficulty of getting enough water by the mouth.
- Give physiological salt solution (ʒi to Oi or 4 Gm to 500 c.c.) by Murphy drip method by bowel.
- Give 5 per cent. dextrose solution in same quantities by drop method.

Bowels.

When seen early.
- Saline. Epsom, Rochelle or Glauber's salts, ℥ss–℥ ¾ (15–20 Gm), in half to three quarter glass of water.

Later.
- Enemata—carefully given to avoid exciting spasm.

Bladder.

Watch for retention; if it occurs use catheter. Precede by morphine.

Eliminate the focus of infection.

- Wound laid wide open.
- Remove sloughs.
- Pack with gauze, let heal by granulations.
- Swab wound with 3 per cent. of alcoholic solution of iodine, follow with peroxide of hydrogen and pack with gauze saturated with the iodine solution. (Ashurst and John.)
- Cauterization should *not* be done.

Specific Treatment.

- Use of antitoxin. (For discussion of its limitations and the mode of administration see text.)
- Subcutaneous.
  - Absorption slow, hence, greatly diluted in blood; requires large doses, limited only by expense, e.g., 100,000 units in twenty-four hours, or
  - Fifteen thousand every three hours.
- Intramuscular.
  - Better than subcutaneous, but not as good as intravenous.
  - Dose, 10,000 to 15,000 units once or twice in twenty-four hours.
- Intravenous. Better than above but not comparable to intra-spinal.
  - Can give one large intravenous dose to begin with and subcutaneous or intramuscular doses every day or two following or daily intravenous doses of smaller amounts.
- Park's rule. Use 2,000 units for each ten pounds body weight.
  - In addition antitoxin should be brought into more direct contact with the nerve tissue.
- Intraspinal always to be used if possible.
  - Dose, 3,000 to 5,000 to 10,000 units (6 to 20 c.c.) daily.
  - (For technique see serum administration in Cerebro-spinal Meningitis, Chap. XVII.)
  - For amounts consult Sophian's tables. See Cerebro-spinal Meningitis.
- Intraneural.
  - Into large nerve trunks leading from wounded area, as near the cord as feasible to expose them. (As much as 1,500 units have been put into the sciatic nerve.)
- Intracerebral.
  - An early method. The results have not been encouraging.
- Intramuscular (at site of wound).
  - To bring serum into contact with motor end plates of wounded area.

For Park's method of combined intra-spinal, intravenous and intramuscular dosage see text. Best method.

- Drugs.
  - Purely empirical usage.
  - Phenol (carbolic acid).
    - Dose, gr. v to gr. viiss (0.30–0.50 Gm) daily.
    - Given in 2 per cent. solution in oil.
    - M. xx (1.30 c.c.) every two hours would amount to gr. v (0.30 Gm) a day.
    - Same dose of 3 per cent. would equal gr. viiss (0.50 Gm).
  - Watch urine for smoky urine as evidence of phenol poisoning.

Treatment of symptoms.

- Convulsions.
  - To lessen irritability of centers, and diminish frequency and violence of clonic convulsions.
- Chloral.

Dose, gr. xv (1 Gm) every three hours, or
gr. xxx (2 Gm) every 6 hours,
increasing to gr. xlv (3 Gm) or
gr. lx (4 Gm) every six hours if necessary. (Adult dose.)

- Bromides. In double dose of chloral; either potassium bromide alone or the triple bromides of sodium, potassium and ammonium.
  - Not likely to be effectual alone, but well to combine with chloral.
  - Give in solution in water through stomach or nasal tube, or by rectum in a couple of ounces (60 Gm) warm milk.
- Morphine.
  - Lessens spasms, relieves pain, induces sleep.
  - Indicated before any procedure likely to induce convulsions, such as enemas, rectal or nasal feeding, catheterizing.
  - Indicated during a convulsion.
  - Doses, gr. $\frac{1}{4}$ to gr. $\frac{1}{3}$ (0.015–0.020 Gm) up to gr. i or gr. iss to gr. ii (0.060–0.10–0.120 Gm) a day.
- Atropine.
  - May be combined with morphine.
- Chloroform.
  - Indicated in severe and painful convulsions.
- Inhalation.
  - Intermittently at periods of clonic convulsion.
  - Continuous for hours (not free from danger).
- Magnesium sulphate.
  - (For intradural use see text.)
- Other drugs that have been recommended.
  - Chloretone, gr. xxx (2 Gm), every two hours until sleep occurs.
  - Give in whiskey by mouth or olive oil by rectum.
- Atropine.
  - Indicated as above with morphine or alone to lessen spasms, also to diminish over-secretion of mucus in air passages.
  - Dose, gr. $\frac{1}{100}$ to gr. $\frac{1}{25}$ (0.0006–0.0025 Gm) into contracted muscles.
  - Repeat at four hour intervals.
  - Watch for toxic symptoms, widely dilated pupils, great dryness of mucous membranes, rash, delirium.
- Hyoscine.
  - Has same effect as atropine, but more depressant to cardiac and respiratory centers.
  - Dose, gr. $\frac{1}{100}$ (0.0006 Gm) twice a day.
- Physostigma.
  - Use eserine sulphate, gr. $\frac{1}{6}$ (0.010 Gm), hypodermically every three to four hours.

Circulation.

- Exhaustion from convulsions may indicate use of circulatory stimulants.
- Use digitalis series for sustained effect and caffeine or camphor for immediate effect. (See Chap. IV.)

Prophylaxis.

- Treatment of the wound.
  - Cleanse wound with soap, water, and alcohol, or paint with tincture of iodine.
  - Lay wound open to bottom. Remove foreign particles.
  - Cut away lacerated flesh or
  - Excise wound area; then use
- Antiseptics.
  - Three per cent. alcoholic solution of iodine or phenol pure, followed by alcohol.
  - Pack loosely with gauze saturated with the iodine solution.
  - Dress daily, irrigating with peroxide of hydrogen.
  - Let wound granulate from the bottom.
  - Powdered or liquid antitoxin has been used in the wound.

Antitoxin administration.

- Should be given at once.
- Dose, 1,500 units.
- Best into muscles about the site of the wound.
- Second dose of same amount should be given in eight or ten days.
- Third dose or repeated doses at these intervals until wound is healed are given by most cautious.
- In a child 1,000 units may answer, but 1,500 are better.
- Serum disease, as after diphtheria antitoxin, may follow.
- It is of small consequence.

CHAPTER XXXIII

WEIL'S DISEASE—INFECTIOUS JAUNDICE

This disease is undoubtedly an acute infection characterized by Jaundice of a rather more severe type than the "Simple Catarrhal Jaundice" of gastro-enteritis; but its separation from the milder Jaundice on the one hand and the severe "Icterus gravis" on the other is not easy. Whether due to one organism only or to several is not yet determined.

Treatment. That of all acute infections (see Chap. I).

The patient is put to bed in a well ventilated room, to which the sun has access, in a comfortable bed. Daily sponge baths are given, the mouth properly attended to and quiet and good nursing afforded.

Diet. Gastro-intestinal symptoms are fairly constant and sometimes severe. It is useless to force the diet while these disturbances obtain.

It is better to respect the meaning of the anorexia and refrain from giving food until nausea and vomiting cease and then begin tentatively with milk (better skimmed) or broths, such as mutton and chicken (freed from fat), white of egg, thoroughly cooked cereals, toast; enlarging on the diet as the patient demonstrates his ability to handle larger quantities.

Water should be given frequently in small quantities if there is nausea, in larger amounts if stomach retains it.

Bowels. When first seen a saline may be given of Epsom salts or Rochelle salts or if there is nausea and vomiting, divided doses of calomel, gr. ¼ (0.015 Gm) every half-hour for five or six doses, followed by salts; or salts in divided doses of ʒi (4 Gm) every quarter hour for five or six doses. Neither calomel nor salts should be used in drastic doses. Later enemata or mild salines every day or every second day may be used.

Nausea and vomiting may be alleviated by cracked ice, the application of mustard paste to the epigastrium, stomach washing or the use of such drugs as bismuth subnitrate gr. xv to gr. xxx (1–2 Gm), bicarbonate of soda gr. x to gr. xx (0.6–1.3 Gm) or oxalate of cerium gr. ii to gr. v (0.15–0.30 Gm) or a combination; codeine sulphate gr. ⅛ to gr. ¼ (0.008–0.015 Gm) or cocaine hydrochlorate gr. ⅕ (0.01 Gm) are indicated in more severe cases and even morphine in the worst.

Diarrhea. Attention to the bowels as set forth above, restriction of fat in food and sufficiency of water to lessen the incidence and severity of the diarrhea.

Bismuth in doses of gr. xxx (2 Gm) every two hours is the best drug to use; opium being reserved for the most severe forms.

Colicky pains are relieved by hot fomentations.

Fever. Temperature of 103° F. and 104° F. are reached by the second or third day and may continue for a week or more.

It but rarely requires treatment other than that which contributes to the patient's comfort, afforded by sponge baths.

Nervous Symptoms. Headache, delirium or coma may occur. For the headache the ice-coil is to be recommended, delirium may require small doses of morphine.

Pains in the legs are at times very hardly borne and the applications of hot stupes and mild analgesics, such as the salicylates are required.

Jaundice appears after two or three days and is accompanied by an enlargement of liver and spleen with tenderness of these organs. This jaundice lasts about two weeks. There is no treatment that probably affects the degree or intensity of the jaundice, but the salicylates as being thought to stimulate biliary output have been much used, either as salol, sodium salicylates or aspirin in doses of gr. v to gr. x (0.3–0.60 Gm) every three or four hours.

They have the advantage, too, of acting as antipyretics and analgesics.

Nephritis is a complication that is not uncommon and demands daily examination of the urine.

It is to be treated like acute nephritis under other circumstances. (See Scarlet Fever, Chap. IX.)

Rarer Complications. Hemorrhages from nose, lungs, stomach, bowel into skin or serous sacks.

They should be treated as hemorrhages under other conditions. (See Typhoid Fever, Chap. V.)

A variety of eruptions may accompany the disease in a certain per cent. of the cases but require no especial consideration.

The course of the infection varies from a few days to two or three weeks, the temperature going down by lysis, the jaundice tarrying a little longer.

In a considerable per cent. of the cases a relapse may follow. Fatalities are few.

The intoxication in Weil's disease is severe; often the patient sustains much loss of flesh, and strength is but slowly regained.

Fresh air out of doors, a sufficiency of good food and, when feasible, a change of climate does more to shorten the period of convalescence than drugs. If these are used, such simple tonics as strychnine gr. 1/30 (0.002 Gm) three times a day or nux vomica m. x to xx (0.60–1.30 Gm) three times a day are given. Iron may be used.

Prophylaxis. We know little about the cause of Weil's Disease.

If we could accept the conclusions of Barker and Sladen, resulting from a study of a series of cases and apply them to Weil's Disease in general, prophylactic measures would be obvious, for they say "the sequence of events in our cases, it seems to us probable, was as follows:

"1. Ingestion of tainted meat, containing living paratyphoid bacilli; (2) development of gastro-enteritis due to this microörganism, and (3) the appearance of a catarrhal jaundice due to extension of the gastro-enteritis to the 'biliary passages.'"

SUMMARY

(For general principles see Chap. I.)

Diet.

Refrain from urging food until gastro-intestinal symptoms subside or ameliorate; then
Milk, broths, cereals, white of egg, toast, all tentatively.
Enlarge on diet gradually.

Water.

Give freely when well borne.

Bowels.

Salts, Epsom or Rochelle ℥ss to ℥i (15–30 Gm) in three quarters glass of water.
If there is nausea or vomiting precede salts with calomel in divided doses, gr. ¼ (0.015 Gm), every hour for four to five doses.
Later.
  Mild salines, milk of magnesia, citrate of magnesia or Hunyadi water or enemata.

Nausea and vomiting.

Cracked ice.
Mustard paste (1 to 4 or 5 of flour)) to epigastrium.
Lavage.
  Bismuth subnitrate, gr. xv to gr. xxx (1–2 Gm).
  Sodium bicarbonate, gr. x to gr. xx (0.60–1.30 Gm).
  Cerium oxalate, gr. ii to gr. v (0.15–0.30 Gm).
  Combine the above. Give every two or three hours in water or in the milk.
  Codeine sulphate, gr. ⅛ to gr. ¼ (0.008–0.015 Gm).
  Cocaine hydrochlorate, gr. ⅕ (0.01 Gm).
Severe cases.
  Morphine, gr. 1/16 to gr. ⅛ (0.004–0.008 Gm).

Diarrhea.

- Give water freely.
- Restrict fat in food (skim the milk).
- Boil milk.
- Bismuth, gr. xxx (2 Gm every two hours).
- Most severe cases.
  - Powdered opium, gr. ss to gr. i (0.03–0.06 Gm) every four hours.

Colic.

- Hot fomentations to abdomen.

Headache.

- Delirium, coma.
  - Ice-coil or ice-bag to head.
- Severe cases.
  - Morphine (hypodermically), gr. $\frac{1}{12}$ to gr. $\frac{1}{4}$ (0.005–0.015 Gm).

Pains in legs.

- Hot stupes.
- Salicylate of soda, gr. v to gr. x (0.30–0.60 Gm), every two hours or
- Aspirin same dose and interval.

Complications.

- Nephritis.
  - (See Scarlet Fever, Chap. IX.)
- Hemorrhages.
  - (See Typhoid Fever, Chap. V.)

Convalescence.

- Often slow.
- Open air.
- More food.
- Change of climate, when feasible.
- Tonics.
  - Strychnine sulphate, gr. $\frac{1}{30}$ (0.002 Gm), three times a day or
  - Tr. nucis vomicæ, m. x–xx (0.60–1.30 c.c.), three times a day.
  - Iron.
    - Blaud's pill or Vallet's mass } gr. v (0.30 Gm).
    - three times a day.

Prophylaxis.

- Avoid possibility of ingesting tainted meat and polluted water.

CHAPTER XXXIV

SEPTICÆMIA AND PYÆMIA

Although this condition affords a fairly definite picture, it is by no means easy of definition.

Septicæmia is a state of infection in which the infecting organism is encountered in the blood and yet evidences of infection with recovery of the infecting organism from the blood does not necessarily constitute a septicæmia but may exemplify a far less serious infection called bacteriæmia and the same organism may be concerned in one or the other condition. For example, the pneumococcus may be, often or usually is, isolated from the blood of a lobar pneumonia and its presence in the blood in no way modifies the picture, course or issue of the pneumonia or on the other hand it may be causal of a true septicæmia.

What relationship of infecting organism and host determines the relatively innocuous bacteriæmia and the profoundly serious septicæmia is not yet clear.

If suppurative foci appear in a septicæmia the process is spoken of as pyæmia.

Toxæmia is a term used to express the effects on the body of the toxins or products of bacterial activity irrespective of whether that activity is local in some tissue or general throughout the body in the blood.

As the essence of septicæmia and pyæmia is the same (presence of virulent organisms in the blood), and their difference determined only by the presence or absence of multiple suppurative foci they will be considered together.

The **organisms** commonly responsible for septicæmia are streptococci; and, indeed, it is a streptococcus septicæmia that the unqualified term "septicæmia" usually connotes to the ear of the general practitioner, but the invasion of the blood by many other forms of bacteria may constitute a septicæmia; e.g., the staphylococci; and a staphylococcus septicæmia is usually characterized by the multiplicity of abscesses accompanying it (pyæmia), the pneumococci, the gonococci, the typhoid bacilli, the colon bacilli, the influenza bacilli, pyocyaneus, proteus, Friedlander's bacillus, micrococcus tetragenus, anthrax, bacillus aërogenes capsulatus, meningococcus.

The general symptoms of septicæmia and pyæmia (septicopyæmia) are due to the toxæmia; and the focal and local lesions to the thrombophlebitis and emboli producing infarcts, and abscesses.

The valves of the heart and adjacent structures, like the veins, may be the seat of bacterial activity and furnish infective thrombi (bacterial or ulcerative or malignant endocarditis); and the effects they have upon the organs concerned constitute the pathology of the disease.

The early symptoms are due to the toxæmia and the toxæmia is intense; and, in the absence of a local lesion, suggest one of several conditions such as typhoid fever, acute miliary tuberculosis, pneumonia with tardy consolidation, æstivo-autumnal malarial fever.

In children B. coli pyelitis and, more rarely, grippe and otitis media simulate a septicæmia.

A more accurate diagnosis in the early stage awaits the result of blood examination; its cytology, serum reactions and most of all its culture returns.

Later, heart murmurs, hemorrhagic spots (petechiæ) splenic, pulmonary and renal infarcts, cerebral embolism, suppurative foci, retinal hemorrhages, assure a septicæmia; while the other suspected conditions would take on gradually their classic characterization.

The **early symptoms** are fever, often initiated by chills (and the chills may be repeated or long continued, and, indeed, are characteristic of pyæmia); loss of appetite, delirium or stupor or the typhoid state.

TREATMENT

Rest. Insistency on rest in its broadest significance should be considered imperative. This means a quiet room, comfortable bed, competent nursing, freedom from worries and anxieties, exclusion of visitors.

Room. Whether in the house or in the hospital, it should be chosen with reference to light, ventilation, conveniences of bathroom, access to the open air by veranda or porch, and remoteness from the noises of the street and of the household. **Light** is an important therapeutic agent, the operation of which is too little known in its details. Individuals respond differently to light both in its quality and quantity. One has but to consult his own personal experiences in health to realize what an extraordinary effect upon our moods and emotions and so upon our bodily functions light and shade, sunshine and shadow have, aside from the direct effects of the rays of light upon the body cells themselves. In disease these effects of light should be taken into consideration and the grateful effects of morning or evening sun and the irritating action of the noon-day glare be provided for or avoided.

The destructive effect of sunlight on germ life is too well known to dilate upon here.

Fresh Air. Maximum ventilation is desirable and a corner room with a number of windows affords this. All that has been said of fresh air in pneumonia obtains here both as regards the rationale of its therapeutic action and the technique of exposing the patient to the open air. (See Pneumonia, Chap. IV.)

The room should be stripped of all unnecessary furnishings and be devoted entirely to the patient.

The use of the same room to sleep or rest in by the nurse is to be deprecated because of the bad results to both in ways readily imagined.

If it is not possible to have more than one nurse, she should be relieved at suitable periods by members of the family, to secure her rest in a quiet room remote from the scene of her duties.

Bed. For details, see Pneumonia, Chap. IV.

Diet. While the most virulent cases of septicæmia run a rapid course and are accompanied by anorexia that makes feeding very difficult, the vast majority run a fairly long course that compels knowledge of the theoretical needs of the patient and the arrangement of a dietary to meet them. The theoretical needs have been detailed in Chapter II, while arrangements of dietaries to fulfil them may be seen under Typhoid Fever, Chapter V, Pneumonia, Chapter IV, and elsewhere. (Consult Summaries.)

To epitomize, we endeavor to achieve 3,000 calories daily in the diet and as much more as the patient handles well. The proteid content should be about 80 grams, but need not be rigidly fixed; milk, eggs, bread, cereals, broths (especially those fortified with farinaceous flours), purées, form the basis of this diet and the use of sugar in the milk, in jellies, on cereals, in fruit drinks, and the use of fats, such as cream in the milk, on cereals and butter on bread add to the caloric content of the diet.

Variety is secured by using various milk preparations; buttermilk, koumys, matzoon, zoolak, junket, ice-cream; of eggs by preparing them in different forms; coddled, custard, egg-nog, egg-white, poached; of cereals by using different kinds, incorporating them in broths, or as some of the invalid or infant foods, so numerous in the market; the bread as bread and butter, toast, dry or wet, milk toast, bread and milk, crackers, biscuit.

Frequency of feeding should be every two or three hours as the patients bear it best.

Fluids should be given in abundance; all that the patients want and to those delirious, stuporous or too sick to ask for it, it should be offered at least every hour. It may be given as water, plain, or if grateful, aërated; as lemonade, orangeade or other diluted fruit juices or Imperial drink. (See summary for formula.)

When first seen the **bowels** should be freely opened either by castor oil or salts, Epsom, Rochelle, sodium phosphate, in doses of one or the other of ℥ss–1 (15–30 c.c. or Gm) or by calomel gr. ii (0.12 Gm), best in divided doses, followed by the above or by Hunyadi or equivalent water, or milk of magnesia ℥i to ii (30–60 c.c.) or Liquor magnesii citratis ℥viii–xii (240–360 c.c.). Later the bowels should be kept open by the use of the milder salines mentioned above or by enemata.

Care of the Body. For all the details of care of skin, mouth, nose, eyes, genitals, consult Pneumonia, Chapter IV, or Typhoid Fever, Chapter V, or the Summaries.

Local suppurative processes in pyæmia, of course, indicate surgical procedures.

SYMPTOMATIC TREATMENT

Fever. The nature of the infecting organism, the virulency of the toxins, the presence or absence of suppurative foci, all determine differences in the fever curve. The temperature may run continuously high with slight excursions, or show wide excursions, accompanied by rigors and sweating, especially in pyæmia, or may be relatively low in the more chronic cases.

Hyperpyrexia but rarely occurs; but a sustained high temperature of 104° F. to 105° F. is more common and has the same deleterious effect upon the vital centers. These cases indicate the **local application of cold** in the shape of cold packs or cold sponges repeated at three to four hour intervals if necessary, and prolonged until some effect is made upon the temperature. The most beneficial effects of these baths is upon the circulatory and nervous system. When the rise of temperature is initiated by a **chill**, hot drinks may be administered and heat applied to the feet and body surface until the rigor has passed.

The **sweats** that follow the febrile exacerbations call for luke warm sponges, change of linen and application of sterile dusting powders.

Sometimes the excursions are so tremendous that **collapse** may ensue and demand the application of heat, hot drinks, diffusible stimulants, such as the stronger water of ammonia held to the nose on a towel, hypodermics of adrenalin, camphor or caffeine or strophanthin.

At the onset there may be some **vomiting**, but as a rule this is not prolonged or violent enough to demand interference. Cracked ice may be sucked and counter-irritation applied to the epigastrium in the shape of mustard paste.

Should it become more persistent, as it may, one has to modify the diet, giving the food in smaller quantities more frequently, cutting down the cream in the milk or lessening the intake of sugar, trying various modifications of milk. If the stomach tube is well borne, lavage with warm water may be helpful and the food administered by the tube.

In persistent cases rectal feeding may be required.

Nervous Symptoms. Restlessness, insomnia, stupor, delirium, headaches are all common.

Delirium may be low, muttering, a typhoid state or noisy and wild.

The items of importance to be considered in this state are **fresh air, cold sponges** or **packs,** a sufficiency of food and particularly an **abundance of water.** When it is difficult to give the patient enough by the mouth (3 to 5 quarts) one should have recourse to colonic irrigations and especially the drip or drop method of Murphy.

Noisy delirium is also to be combated by the application of the **ice-bag** to the head.

The patient should never be left alone, lest he do himself harm and in the wild cases **restraint** becomes necessary. The most humane method is by so attaching the bed covers to the side of the bed that his hands and arms can not escape or the patient sit up, but allowing his body some freedom of movement. At times it is imperative to tie the extremities to the bed; knots must be so made that they will not slip and tighten upon the wrists and ankles to their injury.

Drugs. At times are necessary. If the condition is one rather of restlessness and excitability **bromides** in doses of 15–30 grains (1–2 Gm); either the potassium salt or the mixed salts of potassium, sodium and ammonium in equal parts may be administered late in the afternoon and repeated in the evening, as the condition is likely to be worse at this time.

In more severe delirium **codeine** is indicated, best as the soluble phosphate in doses of gr. ¼ (0.015 Gm) hypodermically. In still more severe cases **morphine** is indicated, given hypodermically as the sulphate gr. ⅛ to gr. ¼ (0.008–0.015 Gm) or Majendie's solution m. iv to m. viii (gr. 2/15–4/15; 0.008–0.015 Gm morphine).

If morphine is not well borne or excites as it does in the rare case, one may have recourse to **hyoscine hydrobromate** in doses of gr. 1/200 to gr. 1/100 (0.0003–0.0006 Gm) hypodermically.

Insomnia is met by much the same measures, ice to the head, hot drinks, heat to the feet, if they are cold, and this is especially so in young subjects; by **bromides, trional** gr. xv (1 Gm), **chloralamid** gr. xxx (2 Gm), any one of which may be repeated in two or three hours, or by codeine and morphine.

Headaches may be due to the irritating effects of the toxins or to a localization of bacterial activity in the brain or its coverings. It may be relieved by the application of an **ice-bag** or **ice coil** or by the use of **drugs.** The use of coal tar derivatives is to be deprecated as depressing to the circulation. A very severe headache is better controlled by **morphine.**

Convulsions may occur, but are due in most cases to thrombophlebitis or embolism and not likely to be repeated or prolonged.

Morphine hypodermically in doses of gr. ¼ to gr. ⅓ (0.015–0.02 Gm) is the best emergency drug. If convulsions are repeated the same procedures are indicated as in convulsions from other causes. (See Scarlet Fever, Chap. IX.)

Circulation. Sooner or later the circulatory apparatus is imperilled either by the effects of the toxins on the centers or on the myocardium or by a localization of the process on the endocardium, a malignant endocarditis.

For a detailed use of circulatory stimulants, see Pneumonia, Chapter IV. It is my growing belief that the value of no circulatory stimulant in acute infectious disease is comparable to **digitalis** and **strophanthin.** The latter I use in emergency gr. 1⁄90 to gr. 1⁄60 (0.00075–0.001 Gm) intramuscularly or intravenously and repeat in six to twelve hours if needed. Follow with digitalis m. xxx (2 c.c.) of the tincture (= gr. iii (0.2 Gm) of the leaf) or its equivalent in dosage of some other official preparation three or four times a day until its pharmacological or toxic action is obvious.

I do not believe in the use of alcohol.

Further treatment is directed to the accidents of the disease. These are determined by localization of the process by thrombophlebitis, by embolism and in pyæmia by suppurative foci.

The process may localize on the endocardium or may originate at this site and the treatment becomes that of malignant endocarditis, its attendant embolisms and circulatory impairment.

It may localize upon the brain, giving rise to a meningitis, and is to be treated like a cerebro-spinal meningitis (see Chap. XVII) symptomatically.

Thrombophlebitis may occur in the veins of the extremities and demand rest, slight elevation of extremities, applications of heat, as fomentations, and protection with cotton batten.

Thrombophlebitis may occur in deeper organs, giving rise to secondary results. It is this occlusion of the vein by inflammatory products that furnishes a nidus for the organism and with the heart valves furnishes the infective emboli, which are carried to the brain and cause hemiplegia, monoplegia, aphasia or other disturbances of cerebral function.

The treatment is only tentative. **Emboli** may plug the central artery of the eye and cause blindness, plug the pulmonary arteries and cause infarcts or abscesses and empyema. Treatment of this condition, general and local, is that of Pneumonia (see Chap. IV) with surgical intervention when suppuration intervenes.

Splenic infarcts are common; often of diagnostic import. The pain accompanying them is relieved by local applications of heat or in the worst cases by morphine.

The veins of the liver may become involved and a pylephlebitis, giving the worst prognosis, ensue.

The abdominal viscera may become involved and abscesses result. Visceral abscesses, pylephlebitis, meningitis and endocarditis, all, are of the most ominous significance.

The bones may be affected and osteomyelitis demand surgical interference.

The joints may be the site of a mild **arthritis** and should be treated as such (see Rheumatic Fever, Chap. III) or may suppurate and need evacuation. The muscles and skin, especially in staphylococcus infection, may be the site of multiple abscesses and require incision.

The **kidneys** may become involved. Infarcts with hematuria occur, needing only expectant treatment, or an acute nephritis, to be treated as such (see Scarlet Fever, Chap. IX), or the kidneys become the site of suppuration and, if localized, are amenable to surgery.

Hemorrhages into the skin, petechiæ, are highly diagnostic, especially those in the conjunctivæ. These latter occur peculiarly when the heart is involved.

Erythemata also occur and icterus, but none of these require treatment.

In pyæmia the original site of infection and **abscesses** secondary to the infection indicate, of course, surgical measures.

Certain differences depend on the nature of the infecting organism.

Of the common forms of infection **streptococcus septicæmia** is supposed to be the worst, though there is little difference in prognosis between it and staphylococcus septicæmia, if, indeed, the latter is not the worse.

Streptococci affecting the heart valves, or the meninges or causing pylephlebitis or visceral abscess lead to an almost certainly fatal issue; although endocarditis of the more chronic type, "endocarditis lenta," "bacterial endocarditis," due to the streptococcus viridans of Schotmüller seems occasionally to get well and even one apparently true case of streptococcus meningitis has been reported cured.

Particularly ominous, too, are the streptococcus septicæmias occurring in small pox, scarlet fever, diphtheria and secondary to surgical procedure.

Of better prognosis is the streptococcus septicæmias of the puerperium.

Staphylococcus septicæmia is almost certainly fatal, its course being characterized by multiple abscesses.

Pneumococcus septicæmia gives little chance of cure.

Among other forms of septicæmia are those due to diphtheria bacilli (though streptococcus, staphylococcus and pneumococcus are commonly recovered from the blood with it), to typhoid bacilli, colon bacilli, bacillus pyocyaneus, meningococci, bacilli dysenteriæ and even bacilli fusiformis.

Specific Treatment. For only one of the organisms mentioned have we a specific serum, bacillus diphtheriæ; for some of the others, sera containing certain dimly visualized antibodies.

Scarlet Fever. Streptococci may be recovered from many cases that run a relatively mild course, a bacteriæmia, and it is difficult to establish a criterion for true septicæmia in the sense of this discussion and, hence, to judge of the efficacy of streptococcic sera.

Nicoll, discussing this subject, accepts a certain clinical picture commencing forty-eight hours or longer after the onset, as constituting sepsis; "no fall of temperature or a renewed rise; abnormal swelling of the mucous membrane of the throat; with or without superficial sloughing; profuse nasal discharge; marked cervical adenitis; rapid, often irregular pulse; mental apathy; active or low delirium."

He, working in the Scarlet Fever Hospital of the Department of Health of New York City, used a **serum** prepared under the direction of Dr. Park. Eleven strains of streptococci recovered from the blood, throat and other sources from scarlet fever patients were used in the animals to elaborate this serum; hence, a polyvalent serum.

His dose of this particular serum was 200 c.c.; in young children, 50–100 c.c. injected into loose tissue.

His results warrant his advice to use the serum in all very severe cases of scarlet fever.

Similar efforts with polyvalent sera have been made for some years past, especially in European clinics. One of those best known in Europe is the Moser serum so persistently advocated by the late Professor Escherich of Vienna.

My own impression is that polyvalent streptococcus sera are well worth using in this condition, with the realization that the strains used may or may not be biologically identical with the organisms responsible for the individual case; hence, may be more or less efficacious, depending in a measure on chance.

Vaccine Therapy. Our knowledge of the possibilities and limitations of vaccine therapy is too limited to discuss didactically the application of this measure to septicæmia.

Reasoning that the body is already overwhelmed with virulent toxins, and that the addition of more in the shape of vaccines (endotoxins) is illogical we pause before using them; on the other hand the belief that the response in terms of antibodies may be local at the site of injection urges us to take a chance. Indeed, its use in the severer cases is that of appeal to the last resort and is so far justifiable, but then only with a clear knowledge of the theory and uses of vaccine therapy.

In the more chronic cases the use of vaccines is more encouraging and some cures of malignant endocarditis by the use of vaccines have been reported from reliable sources.

Autogenous vaccines should be used when possible.

If the organism can not be recovered from the blood, local lesion or other reliable source, organisms from other sources should be shown to fix complement before being adopted for use; or, in other words, the probable infecting organism is determined by the fixation of complement in the patient's blood by strains of streptococci recovered from other sources and used as antigen.

Puerperal Sepsis. As I have said the outlook in this form of sepsis is better than in those already mentioned.

Here again the polyvalent streptococcic **sera** may be used in the streptococcus cases and the **vaccines,** too, with a greater hope of success, though here, too, it is in the subacute cases that the best results follow.

G. T. Western, studying 96 cases of puerperal sepsis, 39 of whom gave positive cultures (36 were streptococci), treated with vaccine 56 with a mortality of 32 per cent., and treated without vaccines 44 with a mortality of 55 per cent. Even better results have been reported by others. Others report less enthusiastically. I imagine that in this particular form of sepsis the management of the case in other respects plays a major part in the results. What the management of a puerperal sepsis case should be I am not competent to judge in the midst of arguments pro and con, but, influenced by environment, quote Ward from the Sloan Maternity Hospital, New York: "A. Obtaining adequate uterine drainage, first, by simple vaginal and intrauterine saline douches. This proving insufficient to control the process, explore the uterus once, and once only to make sure it is empty of foreign products, using the finger for the exploration, and with a minimum of trauma to the uterine tissues.

"B. Treat expectantly secondary foci as they arise, and C. Support the general condition of the patient." (*J. A. M. A.,* April 12, 1913.)

Staphylococcus septicæmia may be treated on the same principles with sera and vaccines with even less anticipation of results.

Pneumococcus Septicæmia. Hope from sera depends on the determining strain.

Grouping pneumococci according to the classification followed at the Rockefeller Institute, strains I and II against which sera have been elaborated may be combated by the use of the sera as in Pneumonia, but strain III (mucosus) and IV a heterogenous group yield no active sera.

As a vaccine, group I (Neufeldt) may be used as in pneumonia and some believe that the antibodies provoked are in some measure operative against the other organisms, or a polyvalent vaccine may be used.

Again it must be insisted that these measures are adopted by the desire to leave no stone unturned rather than by anticipation of favorable results.

Gonococcus, B. coli, streptococcus mucosus and other forms of septicæmia may be attacked in the same manner, but with a full realization of the paucity of published results and with the sense of responsibility towards the patient in handling these powerful agents.

Leucocytic Extracts. The late Professor Hiss of Columbia University and his successor, Professor Zinsser, believing that aside from their phagocytic activity leucocytes furnished something of protective value to the body invaded by pathogenic organisms, advocated the use of an extract of the bodies of leucocytes in combating acute infectious diseases.

It is outside the scope of this book to detail the mode of its obtaining and the reader is referred to articles by Hiss and Zinsser or to Professor Zinsser's most excellent book on *Infection and Resistance* (Macmillan).

Its originators and a few followers have been more or less enthusiastic.

I have seen leucocytic extract used on several occasions and while I have not witnessed gratifying practical results, I have seen evidences that it is in no sense inert.

I am not certain that it has been given sufficient trial to discover the potency it possesses and must confess that I have always employed it in the worst cases. I am still loath to give up the fight in a case of septicæmia without giving the patient the benefit of some possible help from the extract, which to my knowledge never does harm.

Transfusion of Blood. At the present time I am using transfusion in septicæmia and in severe infections that may not be truly classed as such, on account of a remarkable experience of my own, the first case in which to my knowledge the method was used for this purpose.

A case of sepsis in a child of twelve, seemingly moribund, recovering after five transfusions from the father's blood.

The case is reported with others by Dr. Lindeman in the *Journal of the American Medical Association,* October 31, 1914.

Reports of the experience of others since and my own observations of improvement in other cases in which the transfusion has been done make me feel that the measure has a place in the therapy of septicæmia.

It is more than probable that the blood of healthy individuals contain in a large per cent. of cases immune bodies to most of the common infections.

The studies of the antitoxin content of normal blood by the Schick reaction for Diphtheria reveals such astonishing positive results, that in the absence of a practical test for other immune substances the use of healthy blood would seem entirely reasonable.

In addition the introduction of fresh blood must be welcome to the patient in an anemic state so decided as that of septicæmia, while other theoretical considerations could be cited for argument's sake.

Methods of transfusion much more facile than the old direct method have been elaborated of late for which special treatises must be consulted. See Lindeman, *Am. Jour. Diseases of Children,* Vol. VI, No. 1; Satterlee and Hooker, *Archives of Internal Medicine,* January, 1914, and Unger, *Jour. A. M. A.,* 1915, LXIV, 582.

The donors must be healthy, show a negative Wassermann and prove to have a blood congenial to that of the patient (non-hemolytic).

For the technique of these tests one should consult hand-books of laboratory method. (See Hiss and Zinsser's *Bacteriology.*)

Theoretically, a parent's blood should be better than a stranger's as more likely to represent the biological characteristics, but this is by no means without exception.

Again, theoretically, a brother's or sister's blood should be better than the parents', but at times it is absolutely uncongenial.

The amounts depend on age, weight, the patient's reaction, and the donor's condition. In my first case 200 c.c. to 300 c.c. were given at weekly intervals for five weeks. In older cases 800 c.c. to 1,000 c.c. may be given. If a good response is obtained it is better to use the same donor than to change, as every now and then in spite of satisfactory laboratory tests an hemolysis in the veins of the recipient occurs with dangerous or disastrous results.

Ottenberg and Libman, however, place implicit reliance in the results of the agglutination and hemolytic test and say,

"In no case in our series in which hemolysis or agglutination did not occur in the test-tube were any untoward symptoms observed which could be attributed to these phenomena."

Their article on Blood Transfusion in the *Am. Jour. Medical Sciences,* July, 1915, is most illuminating.

If the infecting organism is known it is possible to inoculate a donor with vaccines made from it and enhance the protective power of blood before he donates.

Human serum has been advocated especially by Welch.

See *New York State Medical Journal,* November, 1913.

As the serum contains most of the immune bodies an argument might be made for its selection in preference to whole blood and it certainly is less likely to result in unfortunate accidents.

On the other hand I feel that the whole blood is more likely to give the maximum benefit than serum alone.

Prophylaxis. This begins with proper surgical consideration for foci of infection, but the internist must remember that these foci may be latent in tooth, tonsil, sinus and other anatomical nooks and corners and include all these in his routine examination of patients.

SUMMARY

Treatment

Rest.

Quiet room, comfortable bed, competent nursing, freedom from worries and anxieties, exclusion of visitors.

Room.

Provide for light, air, bath-room facilities, approach to porch or veranda if possible.

Bed.

Hospital type, half or three quarters width, woven wire springs, firm mattress.

Diet.

At onset, don't push.

Later, provide for 3,000 calories, or as much as is well taken, and for 80 grams of proteid.

Milk, buttermilk, koumys, matzoon, zoolak, junket, ice cream.

Eggs, coddled, poached, custard, egg-nog, egg white.

Cereals, different varieties thoroughly cooked, used in broths, various invalid and infant foods.

Bread, bread and butter, toast, milk toast, bread and milk, crackers, biscuit.

Cream, butter, cocoa, sugar in milk, in cereals, in jellies, in drinks.

Give food every two or three hours.

Fluids.

Water, plain or aërated, lemonade, orangeade, diluted fruit juices.

Imperial drink (1 tablespoonful of cream of tartar to 3 pints of boiling water, add sugar and lemon peel to flavor).

Bowels.

When first seen.

Calomel in divided doses, followed by salts or salts alone or castor oil.

Calomel, gr. ¼ (0.015 Gm), every quarter hour for six doses; follow in two or three hours by

Epsom, Rochelle, or Glauber's salts or sodium phosphate; of either, ℥ss to i (15–30 Gm), or milder salines.

Such as Hunyadi water,

Milk of magnesia, ℥i–ii (30–60 c.c.),

Liquor magnesii citratis, ℥viii–xii (240–360 c.c.),

Castor oil, ℥ss–i (15–30 c.c.).

or

Salts or castor oil without calomel in same or double doses.

- Later.
  - Milder salines mentioned above.
  - Enemata.

Care of the body.

(See Pneumonia, Chap. IV., or Typhoid Fever, Chap. V.)

Local suppurative processes.

Surgical procedure.

Symptomatic treatment.

- Fever.
  - Cool or lukewarm sponges.
- Hyperæmia.
  - Cold sponges.
  - Cold packs.
  - Cold baths.
- Chills.
  - Heat to feet and body surface.
  - Hot drinks.
- Collapse.
  - Heat to body and feet.
  - Hot drinks.
  - Diffusible stimulants.
  - Stronger water of ammonia on a towel held to nose.
  - Adrenalin m. x to m. xv (0.65–1 Gm) intramuscularly.
  - Camphor gr. v (0.30 Gm) in oil, intramuscularly.
  - Caffeine, sodium benzoate or sodium salicylate gr. v (0.30 Gm) in water intramuscularly.
  - Strophanthin gr. 1/120 to gr. 1/90 (1/2–3/4 mg.) intravenously or intramuscularly.
- Vomiting.
  - Cracked ice.
  - Mustard paste 1 in 2, 3 or 4 to epigastrium.
  - Cut down on diet, and fats and sugars in diet.
  - Lavage and gavage.
  - Rectal feeding.
- Nervous symptoms.
  - Delirium.
    - Fresh air.
    - Cold sponges or packs.
    - Abundance of water.
    - Ice-bag to the head.
    - Never leave patient alone.
    - Restraint in mild delirium.
  - Bromides, gr. xv to gr. xxx (1–2 Gm).
  - Codeine gr. 1/4 (0.015 Gm) hypodermically.
  - Morphine gr. 1/8 to gr. 1/4 (0.008–0.015 Gm) hypodermically.
  - Hyoscine hydrobromate gr. 1/200 to gr. 1/100 (0.0003–0.0006 Gm) hypodermically.

- Insomnia.
  - Bromides gr. xv to gr. xxx (1–2 Gm).
  - Trional gr. xv (1 Gm). Repeat in two or three hours if necessary.
  - Chloralamid gr. xxx (2 Gm). Repeat in two or three hours if necessary.
  - Codeine gr. ⅛ to gr. ¼ (0.008–0.015 Gm) hypodermically.
  - Morphine in persistent cases, gr. ⅛ to gr. ¼ (0.008–0.015 Gm) hypodermically.
- Headaches.
  - Ice-bag or ice-coil.
  - Morphine gr. ⅛ to gr. ¼ (0.008–0.015 Gm) in severe cases.
- Convulsions.
  - Morphine gr. ¼ (0.015 Gm) hypodermically.
  - (See Scarlet Fever, Chap. IX.)
- Circulation.
  - Digitalis m. xxx of the tincture (2 c.c.) or ℥ss (15 c.c.) of the infusion or gr. iii (0.2 Gm) of the leaf three or four times a day.
  - Strophanthin in emergency, gr. 1/90 to gr. 1/60 (0.00075–0.001 Gm) intravenously or intramuscularly and repeat in six to twelve hours if needed.
  - (See Pneumonia, Chap. IV.)

Accidents of the disease.

- Endocarditis.
- Meningitis.
- (See Cerebro-spinal Meningitis, Chap. XVII.)
- Thrombophlebitis.
  - Rest.
  - Elevation of extremity affected.
  - Application of heat, fomentations.
  - Protection with cotton batten.
- Embolism—infarcts.
  - Of the lung.
    - (See Pneumonia, Chap. IV.)
  - Of the spleen.
    - For pain.
      - Local application of heat.
      - Morphine gr. ⅛ to gr. ¼ (0.008–0.015 Gm) hypodermically.
- Arthritis.
- (See Rheumatic Fever, Chap. III.)
- If joints suppurate, evacuate.
- Muscles, abscesses, incise.
- Kidneys.
  - Infarcts—expectant treatment.
  - Nephritis.
  - (See Scarlet Fever, Chap. IX.)

Specific Treatment.

- Bacillus diphtheriæ septicæmia.
  - Diphtheritic antitoxin.

    - Large doses intravenously.
    - (See severest cases, Diphtheria, Chap. X.)
- Scarlet fever.
  - Polyvalent streptococcic sera.
  - (See text.)
- Vaccine therapy.
  - (See text.)
- Puerperal sepsis.
  - (See text.)
- Staphlococcus septicæmia.
  - Sera.
  - Vaccines.
  - (See text.)
- Pneumococcus septicæmia.
  - (See text.)
- Leucocytic extract.
  - (See text.)
- Transfusion of blood.
  - (See text.)
- Use of human serum.
  - (See text.)
- Prophylaxis.

CHAPTER XXXV

ERYSIPELAS

ERYSIPELAS is a disease, deriving its name from its chief clinical characteristic, a redness of the skin due to an inflammation of this structure, resulting from an invasion by the streptococcus pyogenes, sometimes called streptococcus erysipelatis of Fehleisen.

Morphologically and culturally there is no difference between streptococcus pyogenes and streptococcus erysipelatis, but it is probable that the affinity of the organism for the skin is determined by some biological differences and these biological differences constituting strains, and, by mutations, varieties and species, affords one of the most interesting studies of the present moment.

Not only is the skin involved but in rarer instances the mucous membranes. The manner of skin involvement is a very definite one and entirely different from a lymphangitis or cellulitis although the three conditions are but different expressions of the invasion of the skin by the streptococcus pyogenes. The intensity of the inflammation varies, too, from the usual brawny indurated area of erythema, to vesiculation, pustulation, suppuration and necrosis. Any trauma, however trivial, and sometimes too slight to be detected, affords the portal of entry. Again, that something so difficult of definition, which we call susceptibility and affinity determine certain sites of election in the skin. By far the most common site of the infection is the skin of the face (facial erysipelas) constituting 88 per cent. of the whole; the next most common site is the leg. In infants it usually begins about the umbilicus. As a rule it is confined to the part first affected, but may pass from site to site over the whole body and is spoken of as migrating erysipelas.

Infections after trauma, after operation and in parturient women constitutes another class.

The **symptoms** are those attributable to streptococcus toxins, in any case of acute infection by these organisms; after an incubation of three to ten days there is a sudden invasion with chilly sensations or a distinct chill, a rapid rise of temperature, malaise, headache, nausea or vomiting, anorexia, etc. The temperature may run from 102° F. to 104° F. and be very irregular, it may remain high, 104° F. to 106° F. a few days and then become irregular and fall by lysis, or it may remain high throughout and fall by crisis like a pneumonia. The duration of the attack is one to two weeks.

The **local symptoms** are those of a slowly advancing deep scarlet, brawny indurated area of inflammation with a clear cut border as a rule. It may advance up or down a limb and has no respect for direction of lymphatic flow. The skin is hot, tense, burning.

In facial erysipelas the usual site of entry is the mucous membrane of the nose and the skin over the nose is first affected. Out on either side, shaped like a butterfly, spreads the expanding area of inflammation, until the whole face, eyes, ears and scalp are involved. As it recedes the swelling diminishes and the skin looks dry and burned.

TREATMENT

Isolation. Opinions differ about the necessity for isolation. The spread in a ward, in a family and among attendants is relatively rare, so rare as to make the strict rules of quarantine observed in such diseases as small-pox, scarlet fever and diphtheria unnecessary if not unjustifiable; but willing to be charged with an ultra conservatism, I prefer to isolate the patient in a separate room in a hospital or in a house, forbidding visitors and having a special nurse or member of the family, who shall be instructed to burn dressings, properly sterilize her hands after contact with the patient and change her clothes before mingling with the family or others. The physician has but to remember that his hands and instruments are the means of conveyance of infection. Double precaution must be taken by a surgeon and by the obstetrician.

Room. The room chosen should be light and well ventilated and as remote from the rest of the household as possible while fulfilling these requirements.

The facilities of an adjacent bathroom are desirable and access to a veranda, porch or balcony a valuable adjuvant to the patient's comfort and welfare.

An open hearth affords the best means of disposing of infected dressings.

Bed. The hospital type is preferred, a half or three quarter iron bedstead with woven wire springs and a firm mattress. For technique of bed-making see Pneumonia, Chap. IV.

Diet. During the early hours anorexia forbids forcing the food. The swollen condition of the face adds to the difficulty of eating and, of course, when, in the rare case, the pharynx is involved, the difficulty is greatly enhanced. When food can be entertained an effort must be made to meet the theoretical requirements (see Chap. II). This is the more imperative in the long continued cases, more particularly the migrating forms.

Water and drinks made from fruit juices should be administered freely.

Care of the Body. A sponge bath with soap and warm water should be given daily. The mouth should receive special attention. (For details see Chap. IV.)

The eyes should be carefully cleansed with boric acid solution 2 per cent. to 4 per cent., and as in the facial form the eyelids may be greatly swollen, especial care must be given to this part of the toilet; cold cloths wet with boric acid solution may be applied to the swollen lids with comfort to the patient.

A **cathartic** should be given when the patient is first seen. **Epsom salts** (magnesium sulphate), **Rochelle salts** (sodium potassium tartrate) or **Glauber's salts** (sodium sulphate) may be given in doses of ℥ss–i (15–30 Gm) in three-quarters of a glass of water.

One may precede this by fractional doses of **calomel** gr. 1/10 to gr. 1/4 (0.006–0.015 Gm) every ten to fifteen minutes until gr. i to gr. iss (0.060–0.10 Gm) are taken; the salts following in two to three hours. The smaller doses are especially indicated if there is nausea, as they are credited with being antiemetic. Later one may rely on milder salines, such as Liquor magnesii citratis ℥viii (240 c.c.), Milk of magnesia ℥ii (60 c.c.), a Seidlitz powder or Hunyadi water to keep the bowels open; or enemata may be given in preference.

Treatment of Symptoms. Prodromal symptoms of malaise, loss of appetite, headache and a little temperature require no consideration. At the onset the discomforts of a high **temperature** may be relieved by cool sponges and, in very high fever or long sustained, cold baths may be used, much as in Typhoid Fever.

Headache may be relieved by the ice bag, by small doses of **phenacetin** gr. iii (0.20 Gm) every hour for three to four doses or acetanilid gr. iss (0.10 Gm) at the same intervals. Later no coal-tar derivatives should be used.

Nervousness and sleeplessness may be met by **bromides** in doses of gr. xv to gr. xxx (1–2 Gm) or **chloralamid** gr. xx to gr. xxx (1.30–2 Gm) given in the early evening and repeated if needed late in the evening.

If there is **delirium morphine sulphate** hypodermically in doses of gr. 1/8 to gr. 1/4 (0.008–0.015 Gm) is indicated or in the sthenic period **hyoscine hydrobromate** gr. 1/200 to gr. 1/100 (0.0003–0.0006 Gm) hypodermically.

If there are evidences of **circulatory failure** support must be offered in the same way as in Pneumonia. (See Chap. IV.)

LOCAL TREATMENT

Facial Erysipelas. Many measures and applications have been advocated. To enumerate them would be only to confuse and in no way to edify or help. I will mention only those that seem to me to have value. My personal preference has heretofore been for **ichthyol,** which I have used in 25 per cent. to 50 per cent. ointment or painted on pure, applied after carefully washing the face with soap and warm water, but the face is more likely to be dry and uncomfortable under the pure ichthyol. Over this one applies gauze and a roughly made mask with tapes to keep it in place may be applied over all. The advance of the lesion has been thought to have been modified by compression of the healthy skin adjacent. The most common way of effecting this is by the application of collodion. This I have done in most of my cases; sometimes feeling that I had effected something, again seeing no stay of the progress whatever. Indeed it is not easy to convince oneself of the usefulness of any local measure in a self-limited disease, running so short a course and having so low a mortality as facial erysipelas.

Erdman gave the average duration of 500 facial cases at Bellevue Hospital as between six and seven days and the mortality as 5.38 per cent.

Objections to the ichthyol are its odor, its appearance and the besmearing of everything about the patient. The substance is easily removed, however, from the skin or from fabrics by soap and water. **Vaseline** alone affords a certain degree of comfort.

Erdman with his large experience is convinced that nothing local is better than simple **wet dressings.**

He uses **boric acid solutions,** keeping the solutions cold with ice and applies frequently to the face gauze dressings dipped in them.

Powders. Bland powders such as zinc oxide, starch, boric acid or a combination of them, equal parts, dusted on the skin liberally and covered with a light dressing of non-absorbent cotton relieves some of the disagreeable sensations.

Erysipelas of the extremities runs a little longer course than the facial cases. Erdman's thirty-three leg cases averaged 10.88 days with a decidedly higher mortality (27.37), than the facial cases (5.38 per cent.).

Ichthyol is to be used in the same manner as in facial cases.

A very excellent treatment of these cases is the **wet dressing,** especially that of **aluminum acetate.**[1] **Boric acid solutions** are also suitable for these cases, but I fail to see any advantage in the use of the stronger antiseptics, such as bichloride of mercury.

Migratory Erysipelas. This is a very severe form of the disease, both because of the extent of the body involved and because it includes so many of the infant cases.

The mortality in Erdman's fifty-six cases was 50 per cent. The duration averaged 14.44 days.

Ichthyol and the **wet dressings** may be used in these cases, so far as the extent of the lesion makes these measures practical.

---

[1] Formula

Pulv. Alum	ʒi ss.	(6.00)
Plumbi acetatis	℥i ss.	(45.00)
Aq. qs. ad	Oij	(1000.00)

Erysipelas in Infants. Some 8 per cent. of the cases of erysipelas occur in infants under two years of age.

The affection is far more serious than in adult life.

New-borns are especially liable to the disease. The portal of entry is the umbilical cord. The type is migrating; death usually occurs at the end of six to ten days. Complications are likely to occur.

Treatment begins with **prophylaxis** and the proper care of cord, buttocks and vulva.

The treatment consists in the use of **ichthyol, wet dressings, vaseline** and **powders** as in adult cases detailed above. The mortality of infants under two years averages about 40 per cent.

From two years to sixteen years children are singularly free from the infection (about 1 per cent.).

Specific Treatment. Drug specifics in disease have become in these days of searching criticism a woefully depleted company. Among those to deserve banishment from the category are iron and quinine in erysipelas. I can see no good, whatsoever, from their use, but some disadvantages, such as gastric irritation.

Vaccines. One is loath to abandon the hope held out by the use of vaccines in erysipelas and yet the most extensive series of cases (ninety-five) of which I am cognizant conducted by clinicians and bacteriologists with whom I am personally acquainted and for whose work I have the highest regard leads to these conclusions.

"From our experience with vaccines in erysipelas I must state that the duration of the disease was not at all lessened, the mortality remained at the same level, and there was no immunity guaranteed against recurrence, against spreading of the lesion, nor were complications, such as cellulitis and abscesses prevented; from the statements furnished by the patient, moreover, I could not gather that there was any amelioration of the subjective symptoms." (Erdman, *J. A. M. A.*, December 6, 1913.)

Leucocytic Extract. Glowing accounts have followed the use of Hiss' leucocytic extract in the hands of some observers, while others have not been at all convinced of its efficacy. I can only say that its use is attended by no harm as far as I know and the patient can be given the benefit of the doubt without risk.

Transfusion of Blood. In severe cases I should consider the problem as one of septicæmia and hold the same attitude towards the measure as in that condition. (See Septicæmia, Chap. XXXIV.)

Complications. Many of these are surgical and to be treated on surgical principles; phlegmon, gangrene, abscesses, otitis media, œdema of the larynx, periostitis, purulent arthritis, suppurative adenitis, sinusitis.

Others are medical such as Pneumonia and Pleurisy (see Chap. IV), Acute Nephritis (see Scarlet Fever, Chap. IX), Bronchitis, Tonsillitis, Arthritis (see Chap. III), Endocarditis, Septicæmia and Pyæmia (see Chap. XXXIV). Most important among these as a cause of death are Septicæmia and Pneumonia.

Immunity seems difficult to establish and the same individual is prone to suffer from the disease again and again. Moreover, relapses are of common occurrence.

Prophylaxis. Proper attention should be given to lesser traumata that furnish the portal of entry, and particularly in those individuals who have already suffered from the disease.

Such slight traumatisms may be looked for in the nasal mucosa and in the skin about the nose, ear and elsewhere about the face.

A vaccination wound may be the site of infection, or an old ulcer of the leg. In infants it is commonly the navel, excoriated buttocks or vulva. Again operative wounds may be infected and every care should be exercised by the obstetrician to avoid contact with erysipelas.

It is a wise precaution to disinfect a patient's clothes before his discharge from the sick-room.

SUMMARY

Isolation.

Safer to isolate.

Room.

Light and well ventilated.
Remote from noise of household.
Near bath-room.
Accessible, if possible, to veranda or porch.
Open hearth desirable.

Bed.

Hospital type; one half or three quarters iron bedstead.
Woven wire springs; firm mattress.
(For technique of bed-making see Pneumonia, Chap. IV.)

Diet.

Early hours; don't force.
Prolonged cases. (See Chap. II or Chap. IV.)
Water, lemonade, orangeade, alkaline and aërated waters freely.

Care of the body.

(For details see Pneumonia, Chap. IV.)
Eyes, 2 per cent. to 4 per cent. boric acid solutions.
Cold compresses to swollen lids.

Bowels.

Rochelle, Epsom or Glauber's salts, ℥ss to ℥i (15–30 Gm),
or

- Calomel, gr. 1/10 to gr. 1/4 (0.006–0.15 Gm), every ten to fifteen minutes until gr. i to gr. iss are taken, followed in two or three hours by salts in doses named above.
- Later.
  - Milder salines.
    - Liquor magnesii citratis, ℥viii (240 c.c.).
    - Milk of magnesia, ℥ii (60 c.c.).
    - Seidlitz powder.
    - Hunyadi water.
    - Enemata.

Treatment of symptoms.

- Fever.
  - If high, cool sponges.
- Headache.
  - Ice bag to head.
  - Phenacetin, gr. iii (0.20 Gm) every hour for three to four doses, in early stages.
  - Acetanilid, gr. iss (0.10 Gm) at the same intervals, in early stages.
- Nervousness.
  - Bromides, gr. xv to gr. xxx (1–2 Gm), either potassium or mixed bromides.
- Insomnia.
  - Chloralamid, gr. xx to gr. xxx (1.30–2 Gm),
  - or
  - Trional, gr. x to gr. xv (0.60–1 Gm), in early evening and repeat if needed.
- Delirium.
  - Morphine sulphate, gr. 1/8 to gr. 1/4 (0.008–0.015 Gm), hypodermically.
  - Hyoscine hydrobromate, gr. 1/200 to gr. 1/100 (0.0003–0.0006 Gm), hypodermically, only in sthenic stage.
- Circulation.
  - (See Pneumonia, Chap. IV.)

Local treatment.

- Facial erysipelas.
  - Ichthyol.
  - Twenty-five per cent. to 50 per cent. ointment.
  - Vaseline.
  - Wet dressings of boric acid 2 per cent. to 4 per cent. Solutions kept cold with ice.
  - Powders. Zinc oxide, boric acid and starch equal parts.
- Erysipelas of the extremities.
  - Ichthyol.
  - Twenty-five per cent. to 50 per cent. or pure ichthyol.
  - Wet dressings.
    - Aluminum acetate.
    - Boric acid solutions.
- Migratory erysipelas.

- Ichthyol.
- Wet dressings.

Erysipelas in infants.

- Prophylaxis.
  - Care of cord or excoriated buttocks or vulva.
  - Ichthyol.
  - Wet dressings.
  - Powders.
  - Vaseline.

Specific treatment.

(See text.)
Vaccines, very little value.
Leucocytic extract. (See text.)
Transfusion of blood.
(See Septicæmia, Chap. XXXIV.)

Complications.

Phlegmon, gangrene, abscesses, otitis media, œdema of the larynx, periostitis, purulent arthritis, suppurative adenitis, sinusitis.
Treat on surgical principles.
Pneumonia and Pleurisy. (See Chap. IV.)
Acute nephritis. (See under Scarlet Fever, Chap. IX.)
Bronchitis, tonsillitis, arthritis. (See Chap. III.)
Endocarditis, septicæmia and pyæmia. (See Chap. XXXIV.)

Prophylaxis.

Attention to slight traumata about nose, ears, face; to old ulcers; to cord, buttocks and vulva in infants.

Disinfection.

Patient's clothes should be disinfected.

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